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Disease State Management and it's Application in Inner City Health Care: A Focus on Asthma

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A Focus on Asthma

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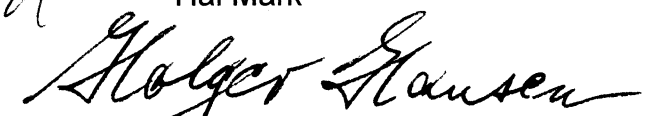
Associate Advisor 
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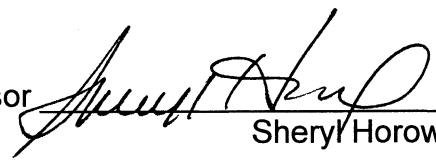
Associate Advisor 
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Introduction

Current Environment

The dominant paradigm of 20th century medicine is the biomedical model of healthcare, emphasizing acute medical treatment and a reimbursement structure favoring hospitalization and physician office visits. Implicit in this model of care is the assumption that health is the usual state of being of the individual and that illness is a temporary aberration. A corollary of this assumption is that episodic interventions will restore the patient to his/her baseline thereby validating the healthcare delivery system. The fundamental nature of chronic disease is however, that it is an ongoing state of being and hence cannot be managed as a temporary aberration from a defined state of health. (1)

Health care in the United States has historically been delivered via episodic care through a fragmented system of providers. As we approach the year 2000, however, capitation-based reimbursement is rapidly reshaping the way health care is conceptualized. A transition is taking place in the current healthcare system that is counter to the traditional belief that a physician's principle responsibility is the care of the individual in his/her state of illness. To operate effectively in the emerging "managed lives" environment, hospitals must redesign themselves as providers of effective, efficient care with predictable and beneficial outcomes, not only in the hospital setting, but across the continuum of care, emphasizing prevention and health maintenance rather than treatment of disease or disability.

Hospitals represent the single largest provider of health services in their communities. In 1990, 38% of all health care expenditures, 269 billion dollars, were related to hospital care. (2) Not for profit hospitals provide a disproportionate amount of essential community care such as trauma, Emergency Medicine services and intensive care to all socioeconomic groups. When delivered to the poor, these high cost services are often not reimbursed.

Internists and pediatricians, the physicians whose services include education and counseling for patient self-management, have seen their relative reimbursements diminish. In addition, the emphasis on market advantage and financially covered lives and increasing intolerance of cost shifting among payers, one of the historical methods of covering the costs of care for the uninsured, is creating potentially insurmountable disincentives for providers to treat persons without insurance. (3)

To thrive in this climate health care providers must accurately and proactively identify patients who cannot independently manage their own health care needs outside the hospital setting and assist them to obtain the most appropriate level of care. As the complexity of health problems increases, it will mandate a thoughtful, multidisciplinary team approach with access to interventions at various levels of intensity. If costs are to be controlled and quality improved, a new approach is needed which focuses on market based systems management oriented around a particular disease. (4) Disease Management is the dominant paradigm that will take us into the 21st century.

Asthma: A Public Health Perspective

Asthma care, especially in the inner city population, is a challenge of enormous magnitude. According to the CDC, the prevalence of asthma in the U.S. is 14-15 million people who were responsible for 500,000 hospitalizations in 1996. (5) The annual costs for asthma care in 1996 were greater than 9 billion dollars, a figure that has doubled since 1985. Clinical, financial and social issues are additive in their effects on this disease and complicate its management. Historically, the emergency department has been the safety net for this group of patients. Patients lack of understanding of their disease and education about its care leads to the inappropriate use of medical resources, resulting in the multi-million dollar a year cost that we now face. In particular, poor and minority populations have a disproportionately high prevalence of asthma and have higher rates of asthma related hospitalizations, physician visits and mortality. Although asthma prevalence rates in the United States for non whites are only slightly higher than those in whites, asthma related hospitalizations and mortality rates for nonwhite are more than double those of whites. (6) In recognition of the trends in asthma related morbidity and mortality, the Public Health Service's National Health Objectives for the year 2000 added for the first time, three asthma related objectives that target high risk populations. (7) This report calls for reductions in asthma related hospitalization rates, control of environmental triggers, and improvement in functional capacity.

According to the National Asthma Education and Prevention Program (NAEPP) Expert Panel, asthma is classified as a chronic inflammatory disease of the airways. (8) Many causative factors have been identified as potential risks in the expression of asthma. It has been well established that genetics play a role in the pathophysiology of asthma. Early childhood manifestation of atopic dermatoses is a risk of the development of asthma in later adolescence. (9) Environmental and occupational allergens or irritants have been identified as specific triggers of asthma, including inhalant allergens (pet dander, house dust mites, cockroach antigens, and pollens), occupational exposures (industrial fumes, gases, chemicals), and irritants both indoor and outdoor (tobacco smoke, aerosol sprays, perfumes.) (10,11) Recent studies suggest that new vaccines and antibiotics may contribute to the rising prevalence of asthma. While protective against serious disease, investigators postulate that they may alter the immune system and suppress its ability to respond to certain allergens. Other studies have suggested that the rise in indoor activities, television and computers, has increased the exposure to indoor allergens, thereby increasing the incidence of asthma.

In addition to the physiologic irritants, the socioeconomic status and psychosocial aspects of the disease represent a more formidable challenge. Poverty, in particular, has been identified as a major determinant not only of asthma, but of many other high-risk chronic diseases found in the inner city population. Many of our urban inhabitants face significant barriers to a healthy life including unemployment, lack of economic stability, lack of affordable and

suitable housing, crime and violence, both in the home and in the community. In the last decade, federal funding for public housing in the inner city has declined leading to deterioration in maintenance and an increase exposure to dust mites, animal dander and cockroaches. This, coupled with crowded living conditions and infectious agents, may represent an additive risk to the development and exacerbation of asthma.

Variation in the clinical practice of asthma care is another area of concern regarding the high-risk asthmatic patient. Clinical guidelines are inconsistently implemented by providers both in the primary care community and the subspecialties. The NAEPP details a systematic approach to the care of the asthmatic patient. Component 1: *Measures of Assessment and Monitoring* emphasizes the initial assessment and making the correct diagnosis. Component 2: *Control of Factors Contributing to Asthma Severity:* addresses the need to reduce exposure to allergens and irritants. Component 3: *Pharmacologic Therapy,* offers an extensive discussion of the pharmacologic modalities available to the practicing physician. Component 4: *Education for a Partnership in Asthma Care,* states that education is the cornerstone of asthma management. (8) Education should begin at the time of diagnosis and be integrated into every step of clinical asthma care. Those who care for asthma patients assume that they will have a continual relationship with patients who can and will follow a recommended treatment plan. Few providers have the training to manage the complex social, economic and cultural issues that exist in the interface between the poor inner city patient and the health care system. (12)

The Emergency Department has been the safety net for the inner city patient. However, most ER's do not provide the ideal setting for comprehensive asthma care which includes patient education, continuity in follow up and consistency in attention to clinical and psychosocial issues. The importance of continuity of care, both episodic and emergent, as well as proactive health behaviors for chronic disease management cannot be over emphasized. Patients need to be convinced of asthma's potential morbidity and the need to obtain the necessary knowledge, and self- management skills, as well as comply with treatment plans in order to control and minimize the exacerbations of their asthma. Several studies examining asthma mortality have clearly demonstrated a link between lack of physician and patient knowledge of appropriate asthma management and asthma death. (13)

One of the most comprehensive surveys of public, patient, and professional knowledge, attitudes and behavior regarding asthma in the United States was conducted in July 1988. "Asthma in America" explored asthma prevalence, the frequency and severity of symptoms, utilization of emergency care, quality of life and quality of care issues. (14) The survey screened 42,000 households which had at least one member with asthma as well as a random sample of 1000 adults in the general public. In addition, more than 700 healthcare workers including physicians, nurses, and pharmacists were interviewed. The survey resulted in five major conclusions:

- Asthma management in America falls short of the goals established by the National Heart, Lung and Blood Institute, part of the NAEPP 2

- Poorly controlled asthma causes hospitalizations, emergency room and urgent care visits, sick days and activity limitations that may result in a much lower quality of life for asthma sufferers.
- Although physicians report that they are following the NHLBI guidelines and patients are generally satisfied with their care, the level of care reported by patients does not meet current standards.
- There is widespread misunderstanding by patients of the underlying causes of asthma symptoms, as well as confusion about appropriate treatment and other aspects of asthma management, including pharmacologic and non-pharmacologic modalities
- 71% of those surveyed who suffer from asthma believe there is a strong need for more patient education about their disease.

Careful review of the literature supports the premise that organizing and implementing programs targeted to certain high-risk patient populations is cost-effective. Although variations exist with respect to specific goals and outcomes, the overall charge and results of these initiatives have been positive.

Asthma serves as an excellent model for disease management, yet is only one of many chronic illnesses that burden the inner city population. Analysis and understanding of both patient and provider beliefs and behaviors is necessary in order to improve patient outcomes. In order for improvement of asthma and other high-risk diseases to occur, the prevention and control of precipitating factors and behaviors must occur. The delivery of high quality, consistent primary care

with timely and appropriate referrals to subspecialists must be implemented. In addition, culturally and socially accepted programs in disease education and self-management skills must be available. Our health care community must become more accessible and acceptable to our inner city patients. Effective lines of communication between clinical and social services may reduce some of the barriers to care these patients often encounter. Expansion of screening programs into the schools of early childhood development may help to identify high-risk children early on so as to prevent the progression of the severity of their asthma as they develop into young adults. Community based primary care oriented initiatives targeting high risk asthma patients should be developed and implemented to address these issues. The National Heart, Lung, and Blood Institutes program, targeting African- American and Hispanic Children has been instrumental in supporting asthma education programs for these minority groups.

The national trend of the disproportionate burden of asthma on the poor inner city minority populations shows few signs of significant improvement. Although the programs that exist targeting this high-risk population deserves our support, we need to come together to develop standardized evaluation tools to assess the outcomes of these programs, which can be applied to other programs in communities. We must promote a collective commitment to these undeserved communities in order to develop a collaborative public health initiative and allocate our finite health care resources in an efficient and effective manner.

Understanding Health Care in the Inner City

In this era of modern medicine, our society has witnessed many landmark events. One of the hallmarks of 20th century medicine has been the substantial increase in life expectancy at birth. Between the early 1900's and 1950, life expectancy has risen more than four years per decade, increasing from 47.3 to 68.2 years. There have been impressive reductions in mortality that have benefited almost all countries of the world and across all social groups, all be it with enormous differences in extent and pace of progress. Coincident with this accomplishment has been the explosion in medical technology that would lead some to believe it to be the cause of the reduction in mortality to which we have been witnesses.

Contrary to popular opinion, most of the improvement in life expectancy during the first half of the century was a consequence of environmental and social improvements rather than advances in clinical medicine. In the early 1900's for example, 40% of all U.S. deaths were attributable to 11 major infections. In 1973, these causes accounted for only 6%. Thomas McKeown, physician and demographer, stated that the main reasons for the decline in mortality were to be found in better living conditions, especially nutrition, housing, higher levels of education, and improvements in sanitation and water supply. (15)

Coincident with these changes in longevity, were fundamental shifts in the economy and residence of the population. Our population changed from rural agrarian to urban industrial, with the concurrent development of affluent, largely

white suburbs and poor, largely minority inner cities. The proportion of children living in families with incomes below the poverty level rose by almost 4% between 1965 and 1991. (16) More than 1 in 5 people in the United States live in the nations 100 largest cities. Despite these cultural and geographical changes our longevity has continued to increase, although at a slower rate. However another trend has been observed. Life expectancy among blacks, both men and women, has declined and the gap between whites and blacks has widened. A closer look at this statistic draws attention to a problem of even greater magnitude: the disparity between health care available to residents in the inner city compared to suburban dwellers.

Martin Luther King Jr. was quoted as saying,"Of all the forms of inequality, injustice in health is the most shocking and the most inhumane." The fundamental problems that face the U.S. healthcare system, cost, quality, and access, are magnified in our inner cities. Although the current constraints in modern day health care are system wide, it is increasingly difficult to accommodate the needs of the inner city population because of lack of resources in an already stressed health care system. (17) The term "urban health penalty" describes the conditions that exist when healthier, more affluent people leave the city and the remaining residents experience health problems that exist because of the physical and economic deterioration that is left behind. (18) Inner city health problems arise from the complex interaction of socioeconomic factors, behavior, environment and disease that is related to race

and ethnicity. The "urban health penalty," has created a deepening health crisis in the inner city.

Although not exhaustive, the following represent a list of diseases and conditions that are complicated by the inner city residence: tuberculosis, asthma, diabetes, hypertension, mental illness, HIV and AIDS, STD's, trauma and substance abuse. Many of these diseases are associated with poverty with its associated poor nutrition, inadequate and unsafe housing, exposure to violence and lack of a social infrastructure.

Is there indeed a difference in prevalence of chronic disease between poor inner city and non-poor families? It has been well established that the prevalence of asthma is disproportionately higher in residents in the inner city, especially among Hispanics. (19) Federal funding for public housing has decreased over the last decade. The aging housing facilities has led to a greater exposure to dust mites, molds, animal dander and cockroaches, all of which have been shown to increase the risk of asthma.

Examination of data from the 1988 National Health Interview survey on Child Health reveals a substantial difference in health status from poor and non-poor families. Although it was demonstrated that non-poor families were more likely than poor families to report chronic conditions for their children, further analysis revealed that children from poor families demonstrated a significantly higher risk of having a more severe condition. (20) Access and utilization indicators revealed that children with chronic conditions from poor and non-poor families receive substantially different levels of care. Large numbers of children with

chronic conditions from low-income families were found to lack the means to obtain even basic medical services. It was found that these families were twice as likely as non-poor families to be uninsured. Furthermore, children with chronic conditions from poor families were more likely than children from non-poor families to lack a usual source of routine care. (16)

Emergency department visits for non-emergent problems are frequently cited as the cause for rising health care costs. The Hartford Health survey revealed that 22% of the respondents use the ED as their source of primary care. The General Accounting office identified "lack of a primary health care provider" as the leading reason people used the ED for minor health care issues. (21)

There exists a great debate among health care providers and policy makers regarding the inequalities in health care. This debate hinges upon two fundamental issues. The first occurs at the macro level, that which deals with the aggregate effects of medical care on the health conditions of entire populations. The second "micro" level focuses on the effectiveness of specific medical interventions in achieving medical outcomes for a particular group.

One side in this debate maintains that expanded access to medical care is essential to achieve the goal of health care equality. The fundamental assumption is that health services are a major determinant of health status, such that inequalities in health care outcomes are largely the result of the differential access to services. A 1997 report from the Center for Studying Health Systems Change identifies that families classified as low income were more likely than

any other group to report decreased access to health care with in the last three years. More than twice as many uninsured persons reported reduced access (43%) compared with persons who had private insurance (21%). (22) Another report summarizing the state of health of children who live in poverty profiled the familiar litany of adverse consequences including a greater likelihood of receiving poor quality care and dying in infancy. (23) In an earlier study, Franks et al showed that all else being equal, lack of health insurance over a long period significantly increases the risk of premature death. (24)

Bindman et al demonstrated that individuals who believe they have difficulty receiving outpatient care experienced deterioration in their health status that resulted in preventable hospitalizations. Self-rated access to care was lower in communities with greater numbers of uninsured individuals. (25) Other barriers to outpatient care were related to race and poverty, which were also significant predictors of preventable hospitalizations even after controlling for differences in the prevalence of the disease, propensity to seek care and physician practice style.

The other side of this debate contends that medical services have a small effect on health status compared to the socioeconomic determinants. It has been suggested that poor health in socioeconomically disadvantaged populations is more the result of unfavorable social conditions and ineffective self-management than from limitations in access. Social support and geographical differences may affect health more than the recognized biomedical risk factors. (26)

Access to medical services is clearly critical to outcomes in inpatient settings where most of the traditional medical education, training, and research are conducted. However the most medical care occurs in outpatient settings where the actions of patients and their life situations may determine outcomes as much as the actions of the health care professionals and the health care system. The association of good health with access to medical care lead some to believe that better health in people of high socioeconomic status is the result of more frequent interactions with the health care system. However persons of low SES currently use medical services more often than persons of high SES perhaps because of the ineffective use of services by persons with a greater burden of disease. (27)

Progress in reducing health inequalities will be achieved not by increasing access to medical services as by changing the social conditions and lifestyles that account for the persistence of such inequalities. Expenditures on health care and education each consumed 6% of the US gross national product in 1965. By 1995 expenditures on health care increased to 14% while expenditures on education remained at 6%. During that time disparities in health related to socioeconomic status increased. (28)

Medicine and health exist in a social context. Rudolf Virchow, an architect of the biomedical model, observed that medicine is a social science, physicians are the natural attorneys of the poor and social problems should largely be solved by them. The implication is investment in education, improvement in social conditions and the application of results of research on self-management

may improve health in persons of low SES more than expanded access to medical care.

Two recent policy changes at the Federal level should improve access to care for the inner city poor over the next decade. One of them, The Omnibus Budget Reconciliation act of 1990, requires that state Medicaid programs phase in eligibility for all children of poor families. When fully implemented in the year 2002, all children from families with incomes below the federal poverty will become eligible for Medicaid. The provision of insurance to all children from poor families should have a substantial effect on health care in the inner city. Data from the National Health Interview Survey showed that among children with chronic conditions, children from poor families with insurance were as likely as children from non-poor families to have the same access to routine and sick care.

Medicaid plays a critical role in the care for the vulnerable populations of the inner city by directly financing health care providers and by indirectly influencing other revenue sources. In 1993, Medicaid represented almost 35% of the average gross patient revenues to institutions in the 100 largest cities while self pay, mainly bad debt and charity care, represented over 22%. Together, these figure approximate 40 billion dollars, five times the level in 1980. (17)

However, Medicaid is a device for paying the bills, not a mechanism for guiding families to appropriate care. Under the current system, Medicaid families must search through various sources to locate and access the appropriate

provider. These families are the least capable of doing so and often opt for the path of least resistance: the emergency room.

Interventions based on the medical model alone hardly provide adequate results in this population. If we truly wish to reduce inequalities in health, we must address the social inequalities that so reliably produce them. This issue calls for a comprehensive urban partnership initiative to address all aspects of the urban penalty: social, economic, and health; and stress the communities' coordination and collaboration in assisting individuals in helping themselves. According to Link, "Through this reorientation, we will be successful in assuring the health of our community in the truest sense." (29)

In an editorial, Jessie Wing M.D. from the CDC, illustrates this view with respect to health care in the inner city,

"To begin addressing some of the issues that affect the health of our inner city communities, we must be willing to develop solutions that are timely, culturally sensitive and acceptable to these communities. These complex health problems will require thoughtful, multidisciplinary approaches and interventions at multiple levels. Partnerships between inner city community leaders, health officials, and policy makers need to be fostered to develop successful interventions". (30)

Disease Management addresses many of these issues because it is a comprehensive, collaborative, multidisciplinary approach to health care delivery and health prevention.

Disease Management: Definitions and Components

Over the past 25 years, the United States has seen an explosion in health care costs. People have searched for ways to control the growth of healthcare costs, which now exceeds 15% of the GNP. As Americans shy away from the idea of government regulation, the private marketplace has been relied upon to address this issue.

The 1980's saw the advent of the health maintenance organization. The "quick fix" was thought to be to reduce hospital admissions, as reducing payments to physicians and hospitals had run its course (31). The American consumer of health care became furious that HMO executives were earning millions while seeming to deny care to the public.

In the mid 1990's, a new movement entered the market place, Disease Management. Initiated by the pharmaceutical industry in response to the fear that HMO's would reduce their budget for medications, Disease Management has now grown to be major player in the health care model. (32)

The Boston Consulting Group first described disease management as a new paradigm in a 1993 report on the Pharmaceutical industry. Since that time, disease management has emerged as a significant force in the transformation of our current health care delivery system.

Disease management (DM) is defined as "systems-based, physician directed, proactive care management of the total patient across the continuum of care with the goal of enhanced patient outcomes and reduced total cost of care." (33) DM is a process of providing comprehensive, cost effective care over the

healthcare continuum with a focus on collaborative care, prevention of acute episodes and development of patient self-care skills.

There are three main components of Disease Management:

- A knowledge base that defines the natural history and economic structure of a disease and includes guidelines regarding the care to be provided, by whom and in what setting for each particular juncture in the disease process.
- A health care delivery system comprised of partnerships between primary care providers, subspecialists, social organizations and other institutions that provide coordinated care throughout the disease process, breaking down the traditional boundaries that fragment our system.
- A continuous improvement process that measures and evaluates clinical, financial, satisfaction and health status outcomes, refines treatment standards and guidelines, and continually ensures the highest quality of health care is delivered to the patient and their families.

A review of disease management initiatives in the literature reveals several health care organizations throughout the country that are significantly involved in disease management strategies in various capacities. Wilbur Pittinger of PCS Health Systems, Scottsdale, Arizona, states that "the rationale for disease management and prevention is so compelling that we have not identified anyone who does not have an interest in it."(34)

Although much has been written about the disease management movement, there have been few outcome studies demonstrating success of specific initiatives over time. The following is a brief sample of disease management programs that have reported some success:

- John Deere Health Care has taken on 11 of its most costly diseases in its employee only staff clinics and invested in the design and implementation of disease management initiatives. They were able to reduce hospital stays and emergency room visits for asthma after less than one year from implementation. (35)
- Merck-Medco and Eli Lilly developed a diabetes initiative in 1993 that resulted in an average per patient savings of $471 per year via patient education and support. (36)
- Stuart Disease management Services conducted a pilot program for congestive heart failure. The program achieved a 68% decrease in hospitalizations, with a parallel increase in physician office visits of 142%. (37)
- Lovelace Health Systems in Albuquerque New Mexico has demonstrated significant outcomes in several disease management initiatives including, asthma, high-risk pregnancy and diabetes. They have set themselves apart as a leader in disease management. According to Lovelace, "it is the right thing to do". (38)

Although much of the data on these early disease management initiatives are preliminary, their results are promising. In 1999, the American Medical Association reiterated its support of disease management. Now incorporated in their official policy, the AMA states that the goals of disease management should be to improve outcomes by the provision of timely and appropriate preventative, therapeutic, and restorative services. (39) DM should promote cooperation between primary care and subspecialty physicians and most of all place major emphasis on education, empowering patients to more successfully manage their own health and intelligently use health care resources. Payers, MCO's, and integrated health care systems have invested much into the development and implementation of such programs and are optimistic about the future success for stakeholders and patients a like.

Blueprint for Developing a Disease Management Program

Needs Assessment

The initial step in the development process is choosing a disease state to target. Disease management is most applicable to disease states for which much information is known, evidence based protocols are easily developed and outcomes which are sensitive to change can be measured. The disease states targeted should be those that are high volume, high cost, high morbidity and mortality, and a financial risk to the organization. With these criteria in mind, we chose to target our asthmatic population. (Asthma Control & Education A.C.E. Program)

Once the population is identified, a careful evaluation of the organization's clinical and administrative database on the specific disease is essential. Costs, both direct and indirect, with respect to Emergency department visits, hospitalizations, physician office visits, and disease specific charges, are a few of the data elements one needs to examine. The data should be collected and tracked in a consistent fashion based on such identifiers as ICD-9 codes, discharge statistics or claims data. Whichever is chosen (which is ultimately based on ease of acquiring such data) continue to track the data in a consistent fashion preferably on a monthly or quarterly basis.

Benchmark Data

The next step in the design phase is to conduct a survey of benchmarked programs and perform an extensive literature search for best practices accepted guidelines and thorough disease overview. There are numerous resources (Medline, Internet sites, discussion forums, etc.) that can provide valuable information on existing programs and clinical practice models. This information will serve as a guide when designing the educational materials and content of the specific programs. Site visits at regional and national centers, which have demonstrated success in their initiatives with similar populations, should be arranged. National conferences on disease management are an invaluable resource to obtain information on existing programs and allow one to network and build collegial relationships with those in the field. The National Managed Health Care Congress (NMHCC), The Zitter Group, and the Disease Management Association of America (DMAA) are just a few of the many conferences held throughout the year. Lovelace Health Systems holds a weeklong seminar on disease management for those interested in a more in depth experience. The resources available are infinite and those that have experienced early success in disease management have been extremely generous with their time in sharing their experiences and lessons learned along the way.

Identify the Partners and Assemble the Team

Identifying the key players is essential to the success of a program. A multidisciplinary team with representation from all disciplines involved in the disease process must be assembled. It is imperative that a well thought out vision and mission be clearly articulated. Is the focus going to be inpatient or outpatient? Will it be primary care based or subspecialty driven? Will it be based out of community practices or at a large tertiary center? It is important to define the scope of the program in order to anticipate the resources that will needed to execute and maintain the program.

A "physician champion" is necessary to lead the charge and provide the clinical expertise with respect to guidelines, best practices and clinical outcomes. Of parallel importance is the role of a "champion" from outcomes research. Together, they must identify data elements that are both clinically relevant as well as feasible to measure. It is important to complement clinical measures with economic and quality of life outcomes, while not limiting the patient and burden the staff with laborious exercises in data acquisition.

The next step is to recruit the "in the trenches" players that are essential to the success of the program. The foundation of our A.C.E. program is our asthma nurse coordinator. In view of the fact that more than 90% of the patients enrolled in our program are Hispanic, our asthma nurse educators are bilingual, and bicultural so as to meet the cultural and social needs of our population. A primary care provider is the physician champion and together they form the core

of the initiative. Other necessary team members include pharmacy services, social services, substance abuse and smoking cessation, the emergency room staff, respiratory therapy and Life Star flight team nurses, inpatient nurses and APRN's, and subspecialty consultants in Pulmonary Medicine and Allergy and Immunology. In addition, partnerships with the managed care organization in which the patients are enrolled are important. In our program, staff from the managed care organization are involved in conducting our home assessments and environmental surveys on all of our patients enrolled in their plan. They provide outreach services as well as supply enrollment data.

Local community agencies can provide community based research, disseminate culturally sensitive educational materials, and help promote change in health and health care policy in the community. We work closely with The Hispanic Health Council and together help identify barriers to care that are specific to our patients in the community. They also provide alternative strategies to overcome these barriers. Finally, the local health departments can provide resources for new initiatives and help collect and coordinate data on the broader determinants of health that assists decision making and resource allocation community wide.

Once a team of dedicated participants has been organized, it is imperative that one create a flow map of the care that is provided in the organization. Include all of the members of the team and actually walk through each individual's area of responsibility. The most valuable participant in this process is a patient from the community. Who better to identify process issues than an

individual that has experience in each segment of the health care environment, from the emergency department, to an inpatient admission, to the follow up appointment process in the primary care practice, to the subspecialty referral, and the visiting nurse in their home? By mapping out these care practices, one will be able to identify “critical junctures” or loop holes in the system where poor outcomes can potentially be avoided.

Outcomes Evaluation

An important aspect of disease management is the ability to measure and report outcomes. This is crucial if the model has not previously been tested. The incentive to collect and report such information has been fueled by the competitive environment in the health care industry. The need to compare mortality among hospitals, and the ability to demonstrate improved quality while reducing costs has elevated the science of outcomes research to new levels. Outcomes research incorporates epidemiological, psychometric, pharmacoeconomic, and clinical effectiveness information and applies it to a disease management strategy. The "outcomes" are measured and used to drive process change and improve quality. Donabedian described quality health care as an optimal triad of structure, process, and outcomes. (40) The outcomes measures incorporated in these evaluations have evolved from traditional clinical endpoints such as survival, morbidity and mortality, or occurrences of clinical events to more patient centered measures such as patient satisfaction, functional health status, and quality of life. (41) Because of the relative infancy of disease management initiatives, it is imperative that the design of the outcome measures is as detailed as the initiative itself, especially if the results are used to guide decision making. (42) The outcome measures should address specific questions; "Is this a worthwhile initiative? What impact did it have on the targeted population? What modifications need to be made?" The data from the evaluation serves to identify opportunities for improvement, document successes, meet

accreditation requirements and can be incorporated in to future business and marketing tools.

The initial step is a careful review of the literature to determine what areas have previously been studied and identify instruments and tools that have been validated. The instruments chosen must be sensitive enough to detect change in the targeted population. The advantage of using instruments that have been widely used in the literature is that it offers the opportunity to set targets and identify best practices with which to compare your results. In general, there are two basic types of instruments designed to measure quality of life: generic health status and disease specific. Generic instruments, which are applied to the general population, measure a variety of characteristics including physical, social, psychosocial and emotional functioning. These tools have broad applications and allow for comparisons across different patient populations. Disease specific tools are more apt to detect small variations in patient outcomes since they reflect disease specific measurements. Despite their specificity, disease specific instruments may fail to identify clinically important consequences of disease not obviously related to its direct effects. (43) The effect of chronic disease on physical, emotional and social functioning has assumed increasing importance. The SF36 and SF12 are examples of widely used and referenced tools that measure functional health status in populations. There is a wealth of data available on the reliability and validity of these instruments, they are available in multiple languages and normative data is available for many disease states. (44)

Clinical outcome measures are commonly dictated by national guidelines. The National Guideline Clearinghouse sponsored by the Agency for Healthcare Research and Quality provides innumerable resources relating to clinical guidelines and best practices. The National Institutes of Health, Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma details the evidence based guidelines for asthma management.

Patient satisfaction should be assessed and reported and again should come from instruments that have been field-tested. The information generated by these reports can be eye opening to the physicians involved.

Of paramount importance in the current health care environment, is the evaluation of financial issues. A "return on investment " analysis needs to be conducted whereby quality improvements are converted to dollars saved, and the costs of running a program are carefully monitored. Financial projections should be made at the start of the program based on anticipated resources, patient population and venue of the initiative. (45) Best and worst case scenarios should be anticipated and in this ever changing world of managed care, various risk assignments as well as fee for service analysis should be included in this "what if" model.

After identifying the measures to be incorporated into the evaluation, the methods and procedures for implementing the evaluation must be carefully explored. Grand plans that are not feasible only result in failure and frustration. This is particularly so in working with the inner city population in which language barriers and complicated lifestyles do not lend to lengthy self completed surveys

or additional attendance at sessions where clinical care is not needed or some other incentive is not provided.

Implementation

At this point, the disease management initiative is ready to be piloted. The most critical element is communication. It is helpful to assemble an implementation team to help with the system wide communication process. Inservices regarding the fundamental principals of disease management, the care process that is to be implemented, the clinical guidelines that will be followed and the value of this initiative need to be delivered to all the clinical areas involved. One may want to videotape this presentation to ensure that all of the staff has a chance to view it. Provide education to individuals at all points of contact about the criteria for enrollment into the program and provide a customer friendly process of access for both the patients and the clinical staff. New forms and data collection tools must be explained and kept in visible areas with the necessary information highlighted. Laminating the clinical guidelines and protocols and placing them in the clinical areas will help improve compliance and consistency of care. It is extremely important that all members of the organization are consistent in their interactions and interventions with patients to decrease practice variation and to minimize patient confusion.

Educating patients and their families is also necessary to ensure the success of the program. Disease management implies a proactive approach to the disease process. Engage the patient and his/her family as active participants in the treatment process. Empower the patient to feel confident in managing his/her illness, recognizing a change in the status of the disease and responding appropriately.

Piloting the Data Collection Process

Once all procedures are outlined and training of study staff has been completed, the data collection process can be piloted. Procedures and training should be designed to address the culturally specific needs of program participants. This may include having instruments available in multiple languages and employing bilingual interviewers. Frequent meetings with personnel involved in data collection can facilitate identification of issues and solutions and make everyone more cognizant of the importance of complete data capture and data accuracy. Reports that outline missing or incomplete data patterns can be very helpful, particularly if busy clinical staffs are assuming this role.

Continuous Feedback and Interpretation of the Data

Continuous feedback of information is important for early identification of issues and keeping those that are providing services in the program informed. Demographic description of the population served, numbers enrolled, individual case studies and aggregate analysis of key indicators such as compliance with standards of care and best practices are all useful. Demographic information helps to identify changes in the population served and perhaps a need to offer different or additional services. Numbers enrolled each month or quarter can help with planning staff resources or business strategies to step up marketing efforts. Analysis of individual case studies may help to identify process problems that can be avoided in the future and aggregate analysis can answer some of the questions defined above, i.e. what impact has this had on a population? Interpretation of the data is an iterative process that relies upon a collaborative relationship between outcomes research and clinical staffs. Results may be descriptive i.e. depict counts or percentages of tests completed, or may be inferential in nature. In the latter case, statistical significance must be carefully interpreted. Some findings may be statistically significant and lack clinical relevance. Other findings may lack statistical significant but be highly relevant from a clinical perspective. The examples provided above emphasize the need for both research and clinical input if meaningful and appropriate applications of the data are to be made.

Asthma Control & Education: A Model of Disease Management in the Inner City

Background

Hartford Hospital's Adult Ambulatory Health Care Program provides extensive services to a predominantly inner city, culturally diverse population that is largely uninsured, disenfranchised, and medically complex. In addition to primary health care, services in women's health, medical and surgical subspecialties, dental and psychosocial services are available to this population. In total, there were approximately 90,000 patient visits during fiscal year 1998. The demand for these services, measured in terms of patient visits, has grown substantially over the past several years. The patient population served by this practice has higher age-adjusted mortality and morbidity rates than other, more affluent, suburban populations served by the Hospital. The health care needs of this population -- and the resource requirements to meet these needs -- are therefore greater. The care for the population is largely financed through the State of Connecticut's Medicaid program, which substantially under-reimburses the Hospital for its costs, and therefore the practice's financial performance historically has been poor. (Appendix A, Figure 1,2)

Profile for the Managed Medicaid Programs

Two years ago, the Governor and legislature instructed the Connecticut Department of Social Services, which has oversight of the Medicaid program, to apply for a federal waiver to operate a Managed System of Care for Connecticut Medicaid recipients. The program began in August of 1995, and was limited to AFDC enrollees; in subsequent years all Medicaid patients will be managed. The vehicle for delivery of services to this population are Health Maintenance Organizations (HMOs). Eleven HMOs and two Federally Qualified Health Centers (FQHCs) have been certified. In addition, two designated providers (Dps) have been chosen. These designated providers, Blue Cross in the East (Tolland, Litchfield, Middlesex, Windham, and Hartford Counties) and Oxford in the West receive enrollments from potential eligible patients who do not sign up for an HMO plan. There is a state enrollment broker (Health Choice) who has the task of assisting with enrollment and informing patients of options and choices. Approximately 225,000 AFDC patients are eligible, 36,000 of which live in the Hartford area. In the last year, 190,500 patients have been enrolled, with almost 48% choosing the Blue Cross Plan.

While Hartford Hospital is enrolled with many of the qualified HMOs there are three major plans that are considered our primary partners. They are: Blue Cross, Aetna, and MD Health Plan. The benefits provided by all of the HMO plans are identical, the differences have to do with delivery system philosophies. Blue Cross is a gatekeeper model with all care directed by the Primary Care Provider (PCP).

While MD Health Plan and Aetna encourage the PCP model, direct access to specialists is permitted. In the case of Blue Cross, MD Health plan and Aetna, Hartford Hospital is either completely or partially at risk which means that the responsibility for reduction of costs lies with hospitals and PCPs since total payments are capitated on a per member per month (PMPM) basis. The partnership between the PCP and the hospital is essential for the Managed Medicaid System to be successful. To achieve this success, major targets are reduction in inpatient admissions, length of stay, Emergency Dept. visits, inappropriate or unnecessary lab testing and specialty care. The formation of well organized centers of Primary Care with the ability to track patients, costs, visits, etc. will be the key element in successful systems.

Community Profile: Health Needs Assessment

In 1997, the City of Hartford's Blue Ribbon Task Force conducted the Hartford Health Survey. This survey addressed the "broader determinants of health" such as environment, social conditions, availability of health services and individual behavior. Given the comprehensiveness of the survey, the following will highlight the most pertinent findings related to the population served in this community:

- **27.9%** Hispanic respondents reported the ED as their usual place of medical care
- Hispanic respondents more frequently noted that the ED was easier to get to and that it takes too long to get an appointment with a MD in the office.
- Examination of the frequency of utilization of health care resources revealed that the Hispanic population was a higher utilizer of the hospital clinics and ED visits and lower utilizer of MD offices, specifically Hispanics comprise **6%** of the population yet accounted for **25%** of hospital discharges for asthma
- Hispanic respondents less often perceive their health as good than other ethnic groups, and have diseases and medical conditions best managed by primary care practices across the continuum
- Hispanic (mainly Puerto Rican) patients accounted for 70.5% of patients. A study focus group of Puerto Rican patients found high levels of dissatisfaction with the current clinic system, which is perceived as impersonal, culturally insensitive and inefficient. Parking and transportation are felt to be a problem.

- Although they may drink and smoke less than other groups, Puerto Rican patients tend to feel that they are less healthy than other ethnic groups, and have a poor self-image. However, they expect a "cure" when they see their physician. Because of their more chronic and psycho-socially complex medical problems, this may contribute to unrealistic expectations about their medical care.
- Cultural beliefs exist that suggest to Puerto Rican patients that "imbalance" and "divine responsibility" account for their medical problems.
- Problems associated with poverty, including promiscuity, spouse and child abuse, contribute to medical and psychological disease.
- Puerto Rican patients often return to the island, fragmenting medical care.

Further analysis reveals that the number of staffed beds in Connecticut has declined 6% since 1995. Furthermore, the projected demand for beds by the year 2000 estimates a further reduction by 34% from the 1997 supply. (Figure 1)

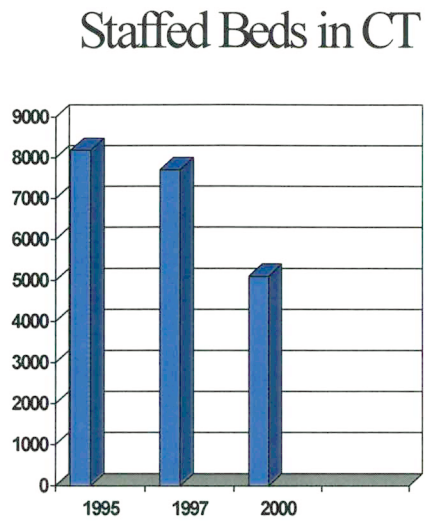
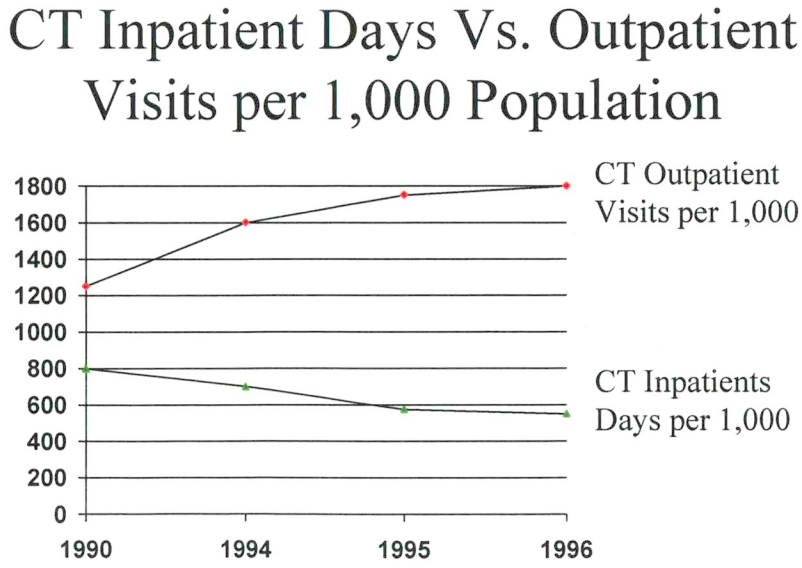


Figure 1: Source: Office of Health Access, FY97 Schedule 500, Staffed Beds

Figure 2 further demonstrates the shift from inpatient to outpatient utilization



Source: American Hospital Association

Asthma at Hartford Hospital: A Historical Review

As stated previously, asthma care in the inner city population is a challenge of enormous magnitude. Connecticut's total asthma discharges have increased by more than 3000 from 1991-1996. (46) These data are particularly disturbing for the minority and socieoeconomically disadvantaged populations. While Connecticut's non-white population comprises just 13% of the total population; it is responsible for nearly 50% of all asthma discharges. Hispanics comprise just 6% of the total population (the majority of which reside in Hartford) they were responsible for almost 25% of all asthma discharges. (Appendix A, Figure 3,4)

The following will introduce some of the initial data from Hartford Hospital that illustrates the impact asthma represents to our health care community. Data was collected for 12 months, tracking the asthma population. Data from January 1996 serves as an example. There were 523 total "encounters" which includes ED, inpatient and outpatient visits. Of these, there were 344 individual patients, which indicates a high degree of recidivism. Relative to the "clinic" population, 284 of the 344 individuals utilize the adult Primary Care Practice for their medical care and were responsible for more than 400 of the total encounters. The total charges tallied $538,000; 46% of which charged for the outpatient services, of which $393,000 was attributed to the significant percentage of "practice" patients. Extrapolating this "conservative" figure to the total patients, yields a total of more than six million dollars a year. (Appendix A, Figure 5,6).

The following illustrates the four most common medical diagnosis as presented to the emergency department for FY'95 and FY'96 (based on emergency department dx):

Emergency Department Visits, Hartford Hospital Clinic Patients

	FY'95				FY'96			
Month	HIV	**Asthma**	HTN	DM	HIV	**Asthma**	HTN	DM
OCT	36	**73**	12	27	37	**55**	21	24
NOV	25	**46**	14	33	44	**53**	16	44
DEC	31	**77**	22	25	22	**61**	15	39
JAN	43	**63**	17	38	34	**61**	18	33
FEB	42	**49**	21	35	29	**56**	27	31
MAR	25	**59**	17	32	26	**46**	24	39

In that environment, this population was served through the standard acute care treatment services. There were neither consistent primary care providers nor a source for comprehensive education. There were no guidelines for referral to subspecialists and no consistent mechanism in place for capturing information about clinical symptoms, functional status, quality of life or deficits in patient's knowledge.

The Asthma Control and Education Program

It can be argued that the implementation of a comprehensive, multidisciplinary model of education and case management, would significantly impact on the quality of life of our asthmatic patients by enhancing their self management skills and increasing their confidence in their ability to manage their illness. Asthma Control & Education (A.C.E.) was developed to address the deficiencies stated previously. A multidisciplinary partnership was formed among primary care providers, emergency department, local community agencies, the managed care organizations and the city health department to ensure a patient focused approach which would cross the continuum of care and promote patient/family accountability. In our managed care, capitated environment, this program would emphasize prevention and health maintenance rather than disease treatment alone. Heath care professionals would be taught to accurately and proactively identify patients who cannot independently manage health care needs outside the hospital setting and assist them in obtaining the most appropriate level of care.

In light of the fact that 70% of the "clinic" population are Hispanic, a RN case manager who is bilingual/bicultural and fully trained in asthma management techniques, is the cornerstone of the program model called A.C.E. The goals of A.C.E. are achieved via the strategic implementation of the following:

- ongoing education of all asthmatics in the identification of precipitants to their asthma attacks and in the proper use of inhalants and home

nebulizers. This is done at the time of the program visits as well as in the home.

- Home assessment, including a thorough evaluation of environmental factors such as mites, rodents or other irritants that may be aggravating their illness.
- Follow up for missed preventative and educational visits.
- Follow up after every emergency room or inpatient encounter regarding an asthma exacerbation in order to reinforce management skills and to reduce emergency resources.
- Facilitation and implementation of community and support services such as home safety and environmental improvements, smoking cessation, psychiatric evaluation, drug and ETOH abuse, nutrition, and allergy and immunology.

The Asthma Control & Education program is an educational program based on the foundation outlined in the Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma (NHLBI). The four components of the recommendations are:

- use of objective measures of lung function to assess the severity of asthma
- environmental control measures to avoid or eliminate factors that precipitate asthma exacerbation's
- comprehensive pharmacological therapy for long term management

- patient education that fosters partnerships among the patient, their family and clinicians

All consenting adults with a primary diagnosis of asthma are referred to the ACE program via three avenues; ED visit, inpatient hospitalization, or a direct referral from the primary care provider. Each individual undergoes a comprehensive intake interview followed by three educational sessions. (Appendix B Figure 1,2) The intake database consists of demographic information, precipitant identification, asthma severity based on the NIH guidelines mild intermittent, mild persistent, moderate persistent, and severe persistent according to asthma exacerbation's, night time awakenings, effect on daily activities, symptoms, daily use of inhaled short acting beta agonists, and spirometry. Surveys on quality of life and functional status, depression and social support are also administered. Following the intake interview, the individuals participate in three educational sessions focusing on understanding asthma as a chronic inflammatory disease, trigger identification, medication use, spacer use and zone management. Zone management involves teaching patients what to do if they are having an acute exacerbation (red zone), having an increase in symptoms (yellow zone), or feeling well (green zone). Medical management is aimed at maintaining individuals in the green zone – a sign of good control.

Periodic assessment of the six domains of patient health as outlined in the NHLBI guidelines are conducted at 3, 6 and 12 months and include signs and

symptoms, pulmonary function, quality of life, history of exacerbation's, pharmacotherapy, and patient provider communication and satisfaction.

Information collected on the following variables:

- Demographic data (A.C.E. intake survey)
- Resource utilization (medical database reports)
- Social and environmental precipitant identification (home environmental survey)
- Clinical severity stratification (NIH scale)
- Health status (Health Status Questionnaire)
- Depression (CES-D)
- Social support (Dartmouth COOP Scale)
- Self management skills information (clinician assessment and rating scale)

In addition, a home assessment and environmental survey is conducted at each participant's home to identify high-risk triggers and precipitants in the home. The ACE team reviews the results of the surveys and makes appropriate recommendations to address areas such as animal allergens dust mites, cockroaches and other irritants. Initiatives such as providing allergen impermeable sheets and pillowcases, removing carpets and upholstered furniture, cleaning and extermination services, are implemented.

Allergy testing, specifically for animal allergens, dust mites, cockroach allergens, indoor fungi and outdoor allergens, is done on all persistent asthmatics. All patients who demonstrate a positive response are refered to an allergist for appropriate follow up and possible allergen immunotherapy. Asthma is commonly associated with perennial and seasonal rhinitis and studies have indicated that inflammation of the upper airways contributes to lower airway hyperresponsiveness. All of our patients are questioned about the presence of symptoms regarding rhinitis/sinusitis and, if coexisting with their asthma, are treated with intranasal corticosteroids.

Physician practice regarding adherence to the NIH guidelines on pharmacotherapy is monitored for quality assurance and consistency of care. Periodic inservices are administered to all involved primary care providers on the proper use of medications according to severity classification. Practice guidelines have been developed based on the NIH guidelines and are implemented throughout the ACE program.

Outcomes Research Project

In collaboration with Outcomes Research at Hartford Hospital, a two-year outcomes project was designed and implemented. The purpose of the study was to evaluate the effects of the A.C.E. Program on clinical and functional outcomes, resource utilization, and to examine the quality of care provided for this inner city predominantly Hispanic population. Using standardized measures and conducting serial assessments of Hartford Hospital asthma patients, the investigators determined: 1) the clinical and functional status ratings for this population at intake, 2) patients acquisition of self management skills and 3) the type and degree of functional impairments present in these subjects, the proportion of the population at each level of illness severity, and the type and frequency of acute care services utilized at multiple points following study enrollment.

Study Design and Patient Population

The study employed a prospective repeated measures design. The study participants consisted of consenting adults, aged 18 years or older, enrolled in the A.C.E. Program from January 1, 1997 to September 1999. Patients were recruited at the time of enrollment in the clinical program. Patients with a primary diagnosis of asthma, with or without comorbidity, were referred to the A.C.E.Program from one of three sources: ED visits; inpatient hospitalization; or a direct referral from the primary care provider.

Using a modified NIH severity scale (excluding spirometric data) changes in asthma severity over time were monitored. Severity is based on clinical symptoms and subjective measures of function, i.e., nighttime awakenings, rescue medication use, symptoms such as wheeze, cough or tightness in the chest with/without exercise, and effects on daily activities.

Surveys on functional status, quality of life and depression were administered. The Health Status Questionnaire (HSQ) contains all the questions in the SF36 and scores for physical and mental well being are obtained. In addition, the HSQ has three additional questions to screen for depression. These instruments measure general well being and provide an overall score as well as breakdown analysis of physical (PCS), and mental (MCS) component scores.

The CES-D is used to screen for depression in populations that do not have a primary psychiatric diagnosis. The instrument was administered to individuals who responded positively to one of the three questions depression items on the HSQ.

Self care skills were assessed via a tool designed by the clinicians in the A.C.E. Program. Responses were rated from 0-2 (not able to demonstrate =0, somewhat able to demonstrate=1, fully able =2)

The following 10 self care skills were assessed:

- Recognition of warning signs
- Use of a metered dose inhaler
- Use of a peak flow meter
- Use of a spacer
- Use of a nebulizer
- Cleaning the equipment
- Use of medications
- Handling emergencies
- Peak flow zone plan
- Recording a diary

Resource utilization was monitored and evaluated by comparing the number of ED and inpatient visits pre and post A.C.E. The Each patient contributed 12 months of pre program data and required at least three patient months of post education data to be included in the analysis. For each patient, the total number and cost of ED and inpatient visits were aggregated and divided by the total number of patient months, to produce a rate of visitation. The outcome measure was the mean number of visits per person per month.

In addition to the aforementioned outcomes the following hypotheses were generated and analyzed:

Hypothesis 1: There is a positive correlation between perceived social support and functional health status e.g. patients with a low level of perceived social support will report lower levels of function.

Hypothesis 2: There is a negative correlation between perceived social support and resource utilization e.g. patients with a low level of perceived social support will have a greater number of ED visits and inpatient admissions.

HYPOTHESIS 3- There is a positive correlation between maintenance of Peak Flows at Personal Best and Functional Health Status

HYPOTHESIS 4- Patients who do not maintain peak flows will have a greater number of ED visits and in patient admissions.

HYPOTHESIS 5- There is a positive correlation between Asthma knowledge and Functional Health Status

HYPOTHESIS 6- Negative correlation between Asthma knowledge and Resource utilization.

HYPOTHESIS 7 – There is a positive correlation between attendance in the ACE program and functional status.

HYPOTHESIS 8 – there is a negative correlation between attendance in the ACE program and resource utilization.

HYPOTHESIS 9- Patients with more severe Asthma (using the modified NIH Symptom scale) will show lower levels of function

HYPOTHESIS 10- There is a positive correlation between Asthma severity (using the modified NIH symptom severity scale) and resource utilization

Results

Resource Utilization/ED

There were 279 patients who completed their A.C.E. education by 9/30/99. In the year prior to the A.C.E. enrollment, 130 patients had 202 ED visits. With 1560 patients months of time prior to the program, the visitation rate was **.13 visits/patient/month.** In the months following enrollment (ending 6/30/99) these 130 patients had 68 ED visits. With 1369 patient months of time from the end of their education to 9/30/99, the visitation rate was **.052 visits/patient/month.**

Therefore, for these 130 patients, **.13/.052** is equivalent to a **66% reduction** in the number of **ED visits.**

Resource Utilization/Inpatient

There were 279 patients who completed their A.C.E. education by 9/30/99. In the year prior to the A.C.E. enrollment, 130 patients had 69 inpatient visits. With 1560 patients months of time before the program, the visitation rate was **.044 visits/patient/month**. In the months following enrollment (ending 6/30/99) these 130 patients had 16 inpatient visits. With 1396 patient months of time from the end of their education to 9/30/99, the visitation rate was **.011 visits/patient/month.**

Therefore, for these 130 patients, **.044/.011** is equivalent to a **76.8% reduction** in the number of inpatient **visits.** (Appendix C Figure 1,2,3,4,5)

Functional Status and Quality of Life

Valid HSQ scores were available for 107 patients at baseline, 3, and 6 months, and 54 patients had complete data sets to one year. There were statistically significant improvements in both the PCS and MCS of both data sets, $p<.001$. (Appendix C Figure 6,7)

Severity Classification

A modified NIH scale severity classification was used to monitor severity over time. The distribution of severity at baseline, 3,6, and 12 months is shown for a matched sample of 85 patients. At baseline, 68.2% of the patients were classified as severe persistent. This improved significantly at three months to only 17.6 %, and 13.1% and 15.3% at 6 and 12 month respectively. This finding demonstrated both statistical $p<.001$ and clinical significance. (Appendix C Figure 8)

Self Care Skills

The nurse educator's assessments of patient's self-care skills were available for 90 matched patients at baseline, 3,6, and 12-month follow up. At baseline 40-80% of the patients were "not at all" able to manage one or more of the 10 self-care skills, very few, 2-7% were rated "very" capable. The percentage of patients that improved is seen in the graph. There were dramatic improvements in the ratings of all 10-skill sets at 3,6, and 12-month follow up $p<.001$ (Appendix C Figure 9,10).

With respect to the hypotheses, an extensive and complete analysis is contained in the appendix. Each hypothesis is accompanied by the statistical analysis and appropriate conclusions. In summary, it has been demonstrated that patients participating in the ACE program have had significant reductions in severity and resource utilization and improvements in knowledge, general health status and asthma specific quality of life. The relationships among these variables and others require additional study with larger samples. Patients will continue to be enrolled in ACE and program performance will continue to be monitored. Data collection instruments going forward will include the SF-12, CES-D, NIH severity, Asthma specific QOL and selfcare skills. Resource utilization will continue to be captured through the hospital's administrative database. (Appendix D)

Discussion

The challenges with respect to the pathophysiology, diagnosis, and pharmacological management of asthma has long been recognized and has been well documented in the literature. However, little attention has been given to the implementation and evaluation of comprehensive disease management programs and their outcomes. This initiative has demonstrated significant improvement in several program specific outcomes such as heath-related quality of life, self-management skills, resource utilization and asthma severity. In addition, this initiative has identified areas for future exploration.

The trends relative to asthma severity over time are encouraging. Review of the baseline demographic information reveals a population of patients, the majority of whom are classified as having severe persistent asthma (69%). Asthma severity was based on the NIH guidelines as mild intermittent, mild persistent, moderate persistent, and severe persistent as defined by asthma exacerbations, night time awakenings, effect on daily activities, symptoms, daily use of inhaled short acting beta agonists, and spirometry. This high-risk population is not surprising given the fact that most of the patients enrolled in the program are referrals from the emergency department or discharges from the hospital. The most significant improvement occurred during the first three months of enrollment in the program. What is even more encouraging is that improvement was consistent at the sixth month follow up despite a reduction in number of visits the patients had with the asthma nurse educator in the time period between the three month, six, and twelve month assessments. It is

important to note that the severity classifications referenced above are based completely on subjective criteria. Despite these significant improvements in asthma severity, there has been little objective evidence of corresponding improvement in spirometry, specifically, fev1. This observation is consistent with previous observations that spirometric data does not necessarily correlate with the patient's perception of the severity of their disease process. (47)

The desired outcome of any asthma education initiative is to effect behavioral change in the patient and family towards enhanced awareness of the triggers of exacerbations and the ability to self manage these episodes. Behavior change is probably the most difficult medical outcome to achieve, sustain and measure objectively. (48) The lack of basic self-care skills in asthma management of the patients prior to entering the program illustrates the enormous challenge that we faced. There was a dramatic improvement in all areas of self-care skills. Again, what is most impressive is the sustained effect found at 6, and 12 months. The success in self management is most likely reflective of the intensity of the education and the awareness of cultural beliefs and practices that enables the asthma nurse educator to communicate these principles of asthma management in an effective fashion while empowering the patient with the skills and confidence to self manage his/her illness. The use of analogies, i.e. the "house analogy "enables the patients to understand basics of asthma management and allows them to become active partners with the health care team in developing an appropriate action plan in which they will participate.

The reduction in ED and in patient utilization of 66% and 76% respectively is not surprising during the first year of a new initiative. The intense training of all personnel in the emergency department and nursing units enhances the awareness and importance of asthma education as well as encouraging consistency of care and use of practice guidelines. Once again, it is gratifying that these same trends were observed throughout the three years of the program's existence. It is also worth while noting that the population is not a sedentary population and the tendency to relocate is frequent. The implications of this are such that the "high risk" patients for one-year may not be the same population the next year. This should be taken into account when tracking utilization data. In one study from Harvard Pilgrim Health, they noted that less than 25% of high-risk utilizers came from the previous year's population.

Health services utilization has historically been used as a surrogate marker for quality of care provided to asthmatic patients. If patients have adequate access to high quality primary care including patient education and appropriate preventative and rescue therapy, the use of emergency health services and hospitalizations should almost be completely avoided. (49)
The association of asthma and allergy has long been recognized. Recent studies have demonstrated that sensitization among genetically susceptible populations to certain indoor allergens such as house dust mite, animal dander and cockroach is a risk for developing asthma in children. (50)

An allergic reaction in the airways caused by exposure to allergens has shown to lead to an increase in inflammatory reaction, increased airway

hyperresponsiveness, and increased eosinophils in bronchoalveolar lavage. (51) Other studies have demonstrated that asthma symptoms, pulmonary function and medication dependence in mite sensitive patients correlate with the level of house dust mite exposure and that reducing the exposure reduces the asthma symptoms, bronchial hyperresponsiveness and evidence of inflammation. (52) These and other reports emphasize that proper trigger identification and exposure reduction become an integral part of asthma management.

The home assessment and environmental survey allows the health care provider to obtain information regarding the patients lifestyle and other environmental risk factors such as poor housing, violence, and substance abuse. It has been well documented that in some populations, 40-50% of asthmatics have psychosocial issues that complicate their medical management. Leland Kaiser, a futurist, once stated that "you cannot understand a disease until you see it in its natural environment." In light of this and other convincing evidence, The Expert Panel report: Guidelines for the Diagnosis and Management of Asthma, has now recommended that environmental control measures to avoid or eliminate factors that precipitate asthma symptoms or exacerbations be part of an effective asthma management program. An enhanced awareness and identification of high-risk environmental triggers will enhance the decrease in resource utilization, improvement in functional status and quality of life, and will enable the patient and provider to participate as a team in their asthma management initiative.

Conclusion

Developing and implementing a disease management initiative is a formidable challenge and depends on several factors for success. First and foremost, the needs of the patient must always remain the focus of the initiative. There must be organizational alignment with disease management woven into its strategic plan. The concept must be endorsed and supported by senior management who are prepared to participate in nontraditional segments of healthcare. Success of the programs also hinges upon the availability and access to sophisticated integrated information systems. These systems must be user friendly and provide end user access to clinical, financial, health status data. Outcomes research staff should support the coordination and analysis of the data with continual feedback to providers based on disease specific and population processes and outcomes. Of paramount importance, however, to ensuring the success of the disease management movement is physician buy in and support. Provider acceptance requires their participation in the process from development to implementation. Guidelines must be developed which will enhance, not impede their clinical judgement. The clinical models must be flexible enough to respect individual style but not encourage variation of best practice.

The landscape of the healthcare environment is ever changing. As disease management evolves, a new prodigy is already on the horizon, the management of population health. The emphasis on wellness and prevention will result in populations with much broader demands on the health care system.

Attention to the psychosocial and environmental aspects of wellness and disease will mandate redesign of existing resources to deal with the challenges these dimensions will create. This is especially true in our inner city communities. No longer do "health only" models of intervention provide adequate results. In an editorial, Link and Phelan concluded, "if we truly wish to reduce inequalities in health, we must address the social inequalities that so reliably produce them." "This issue calls for a comprehensive urban partnership initiative to address all aspects of the urban penalty-social, economic, and health, and stress the communities coordination and collaboration and assisting individuals in helping themselves. Through this reorientation, we will be successful in assuring the health of our community in the truest sense." (53) The futurist, Leeland Kaiser once said, "physicians are architects of communities". The hospitals of the future will be decentralized deinstitutionalized, regionalized, integrated networks of programs and services designed to improve the health and welfare of a population. Never before has our dependence upon integrated networks of health care delivery and information been so strong. The foundation built by the pioneers of disease management thus far has us well positioned to face these challenges and ensure the stability and success of our healthcare delivery system well into the 21st century.

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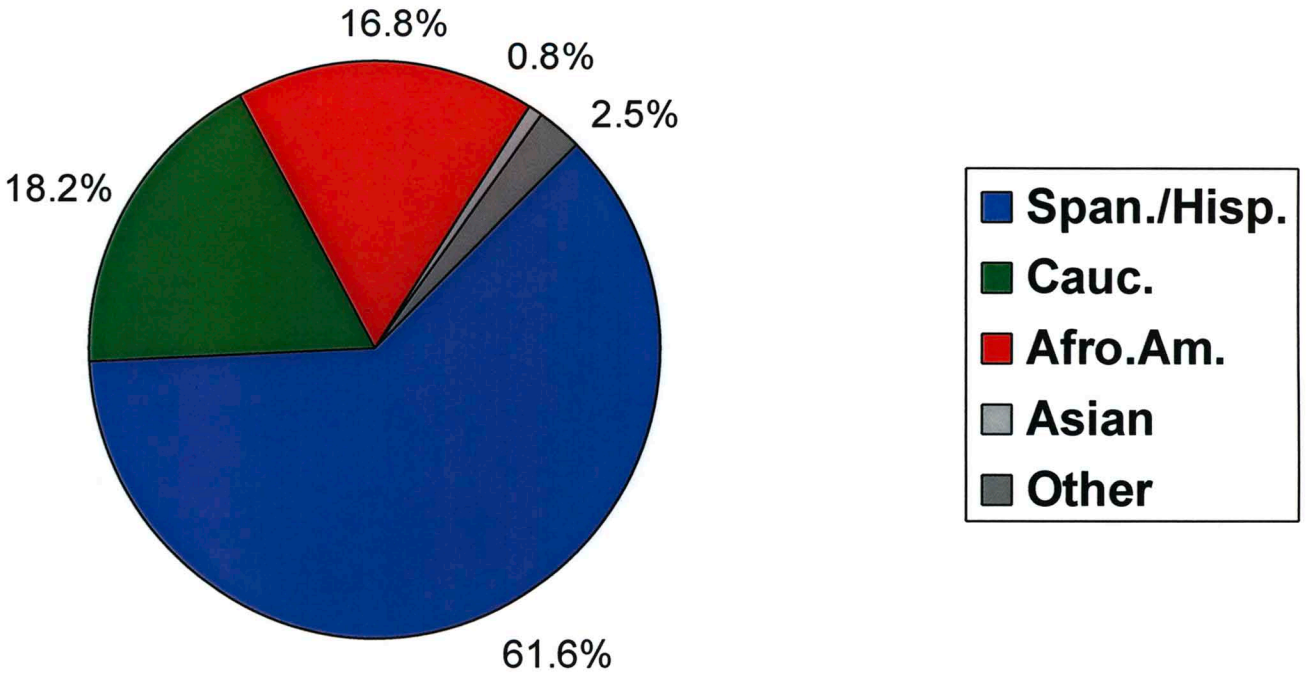
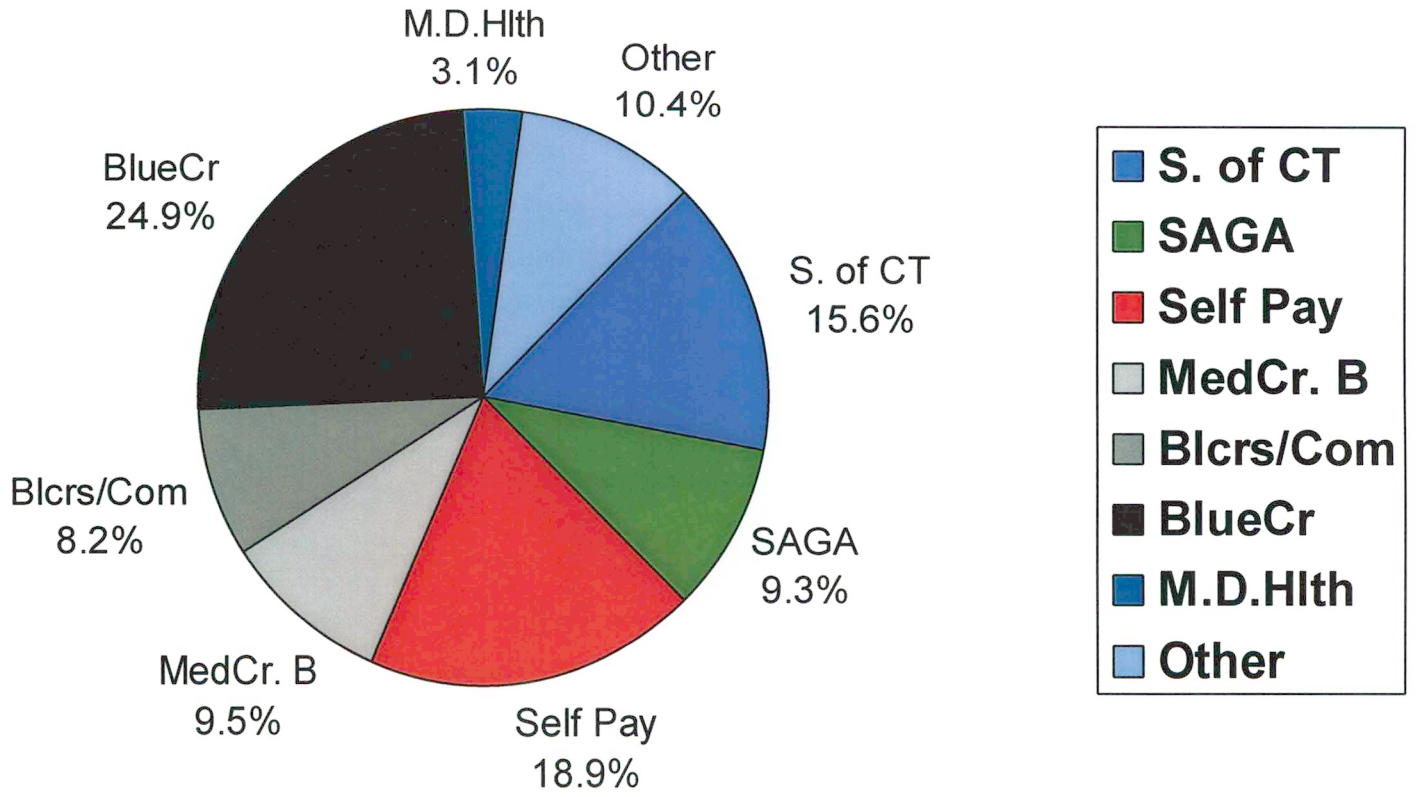
Appendices

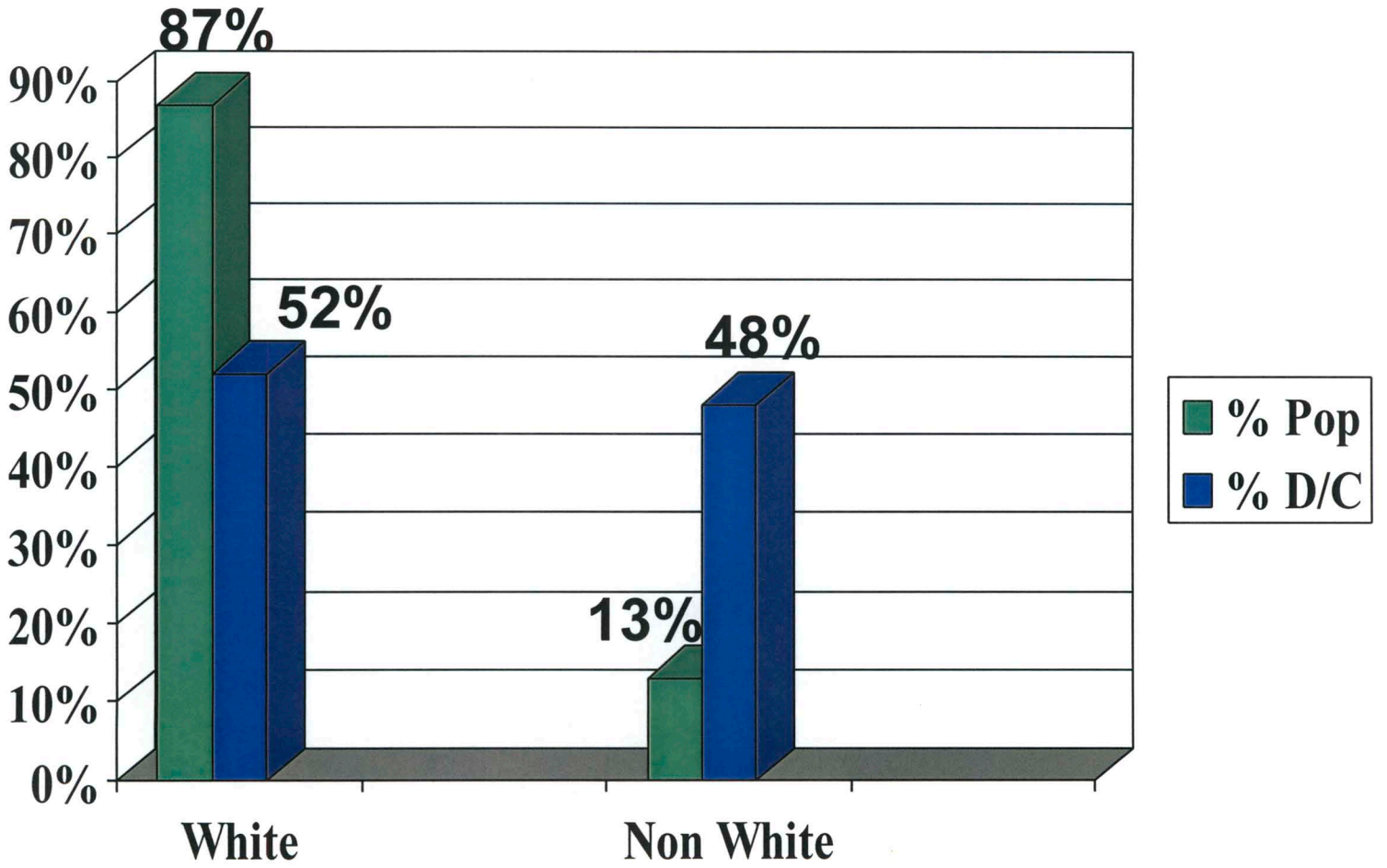
Appendix A Figure 1
Adult Ambulatory Health Care, Ethnicity of Overall Patient Population, FY 1998



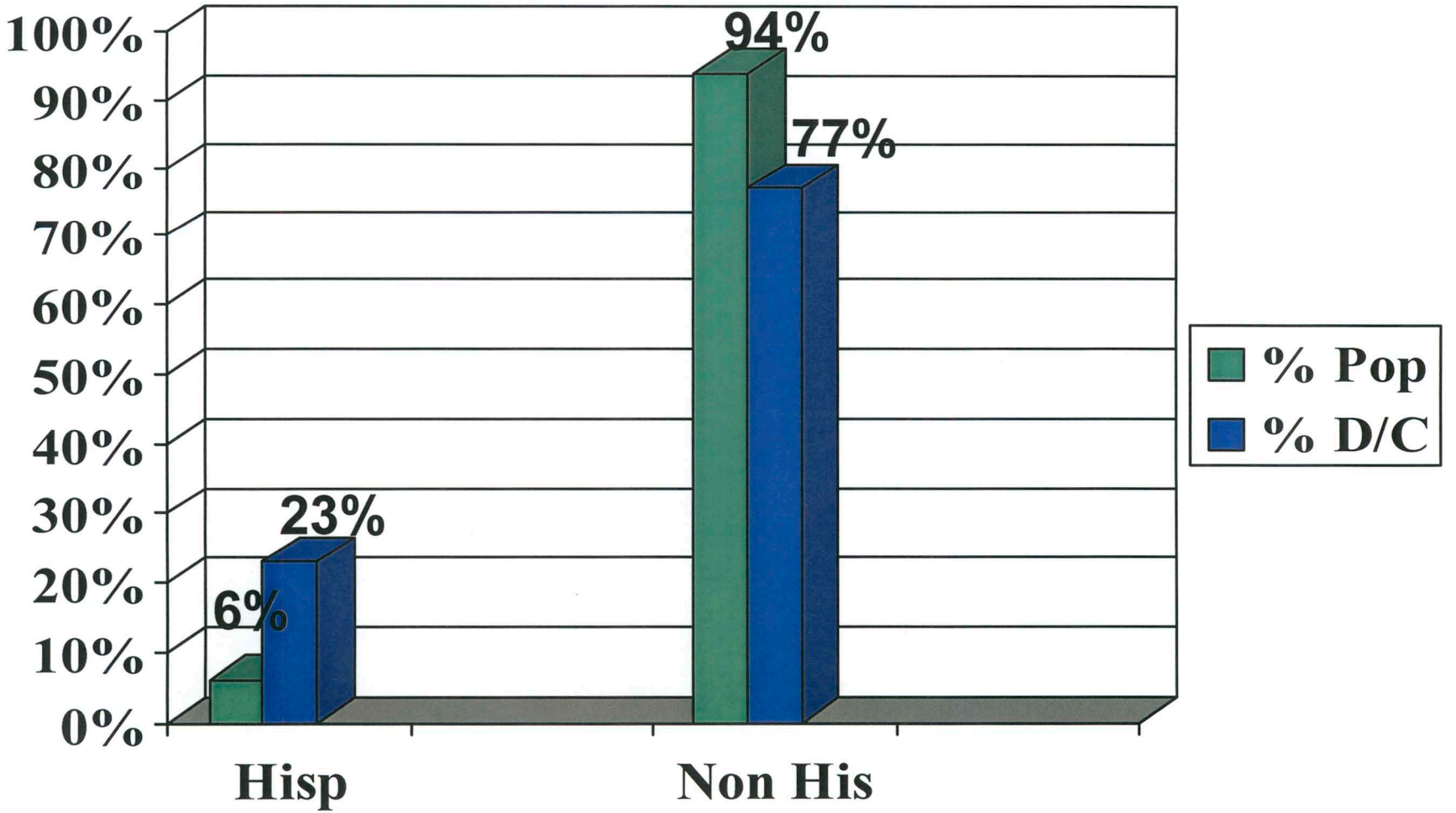
Appendix A Figure 2
Adult Ambulatory Health Care, Payer Mix, FY 1998, Percentage



Appendix A Figure 3 Comparison by racial group, % of population and % of asthma discharges, FY 1996



Appendix A Figure 4 Comparison by ethnic group,% of population and % of asthma discharges



ASTHMA CHARGES FOR MONTH OF JAN 1996

Appendix A Figure 5All Patients

	Total Charges	Average Charge	Total Visits
Total IP	$ 24,376.76	$ 6,094.19	4
Total ED/IP	$ 213,175.40	$ 6,876.63	31
Total ED	$ 47,572.47	$ 417.30	114
Total OPD	$ 253,572.42	$ 678.00	374
GRAND TOTAL	$ 538,697.05	$ 1,030.01	523

344 Individual Patients
523 Encounters

# Visits	# Patients
5	2
4	12
3	28
2	78
1	225

ASTHMA CHARGES FOR MONTH OF JAN 1996

Appendix A Figure 6 Clinic Patients

	Total Charges	Average Charge	Total Visits
Total IP	$ -	$ -	0
Total ED/IP	$ 122,352.90	$ 8,156.86	15
Total ED	$ 17,135.86	$ 408.00	42
Total OPD	$ 253,572.42	$ 678.00	374
GRAND TOTAL	$ 393,061.18	$ 911.97	431

284 Individual Patients
431 Encounters

# Visits	# Patients
5	1
4	4
3	26
2	79
1	174

Appendix B Figure 1,2
Hartford Hospital
ACE Program
Asthma Control and Education

Asthma Curriculum Outline

Every patient referred to ACE will have the following:

1. An intake visit with an Asthma Nurse Coordinator (ANC) lasting 1 ½ hours, including the following:

   A) Demographic data, asthma-specific history, current medication use, smoking History, severity assessment, environmental assessment, immunization/testing information, knowledge assessment, goal setting, plan for referrals if needed and specific plan for follow-up (See Appendix A). Database generated.

   B) Baseline v/s, peak flow reading, spirometry and pulse oximetry.

   C) Health Status Questionnaire (HSQ) - if score shows depression, plan for CES-D will be made.

   D) Education session – Quick teach (See Appendix B)

   - MDI technique
   - Peak flow technique
   - Major triggers
   - Review of medications
   - Early warning signs
   - How to handle an acute episode
   - House analogy (Asthma Pathophysiology simplified), as indicated

   E) Educational packet includes:

   - Krames Booklet
   - One page peak flow diary/individualized self-management plan
   - Wallet card with self-management plan

   F) Peak flow meter, metered dose inhalers, nebulizer, given to patient as appropriate.

   G) Appointment for first follow-up visit within a week.

   H) If referred from ED or hospital, will have Health Reach or VNA home environmental survey within 7 days (See Appendix C).

2. **Post – initial visit, the follow will occur**.

   A) Home Environmental Survey by HR/VNA, if appropriate.

   B) Findings of above survey faxed to Asthma Nurse Coordinator (ANC) with 24 hours of visit.

C) Reminder calls to patient of second visit.

D) PCP gets report generated by ANC/discuss need for change in therapy or referrals.

3. **Second Visit (one hour)**

A) Review of Education session (See Appendix B) with emphasis on medication compliance and emergency plan.
- Review peak flow diary.
- Discuss barriers to care/compliance/follow-up.
- Identify efficiency of MDI vs. Nebulizer during acute episode.
- Describe purpose and advantage of using a spacer.
- Review dosage schedule for lifestyle modification need.
- Review care and cleaning of MDI Peak flow meter/neb,prn.
- Discuss 2 possible emergency scenarios and assess for appropriate action plan.

B) Review of environmental survey with patient; emphasis on identifying and minimizing triggers.

C) Asthma video when reinforcement needed.

D) Educational information on nebulizer cleaning, maintenance, use, prn.

E) Appointment for third visit within one week.

4. Post – second visit

- Reminder calls for third visit.

5. **Third Visit (Half Hour)**

A) Review of Education session (See Appendix B) with emphasis on zoning, emergency plan and scenarios.
- Discuss peak flow diary and zoning concept and using measurement to control asthma.
- Discriminate between action of beta agonist and other MDIs
- Return demonstration of Nebulizer meds and use.
- Detail action to be taken in each of the 3 zones.

B) Determine need for additional sessi8ons and appointment if indicated.

C) Phone access to Asthma Nurse Coordinator, and PCP.

D) Follow-up medical appointment with PCP verified

6. Optional Group Teaching/Support follow-up

Small groups of individuals (6-8 people) will meet once per month for asthma related topics, lifestyle adjustments in chronic illness, updates on new therapies, etc. These sessions will be held in the Hispanic Health council.

Appendix C Figure 1
ACE PROGRAMPATIENTS
Demographic Information

- n = 510 with at least an initial visit by Dec 30, 1999
- n = 151(27.5%) are currently active in ACE
- n = 144 (28.2%) have completed the 12 month ACE program and provided follow-up data by Dec. 30, 1999
- Active/completed program patients:
  - 77.2% (227) Women
  - 86.8% (256) Hispanic
  - 45 Years (Mean) [s.d =12.7, range (18-78)]

Appendix C Figure 2 Results of the Association between The ACE Program and Patient Emergency Department Utilization

There were 279 patients who completed their ACE education by 9/30/99

- **Historical Data**
  - In the year prior to ACE enrollment 130 patients had 202 ED visits. With 1560 patient months of time before the program, the visitation rate is .13 visits/patient/month
  - Total cost $81,567 (mean = $627)

Prospective Data

- In the months following ACE enrollment (ending 6/30/99) these 130 patients had 68 ED visits. With 1369 patient months of time from the end of education to 9/30/99, the visitation rate is .052 visits/patient/month
- Total cost $92,827 (mean = $714)

Appendix C Figure 3
Results Cont'd

- Therefore, for these 130 patients the comparison is:

  .13 ED visits per patient/month before ACE

  versus

  – .052 ED visits per patient/month after ACE

- This is equivalent to a 66.3% reduction in the number of ED visits

Appendix C Figure 4 Results of the Association between The ACE Program and In-Patient Utilization

There were 279 patients who completed their ACE education by 9/30/99

- **Historical Data**
  - In the year prior to ACE enrollment 130 patients had 69 in-patient visits. With 1560 patient months of time before the program, the visitation rate is .044 visits/patient/month
  - Total cost $401,683 (mean = $3,090)

- **Prospective Data**
  - In the months following ACE enrollment (ending 6/30/99) these 130 patients had 16 in patient visits. With 1396 patient months of time from the end of education to 12/30/99, the visitation rate is .011 visits/patient/month
  - Total cost $92,827 (mean = $714)

Appendix C Figure 5
Results Cont'd

- Therefore, for these 130 patients the comparison is:

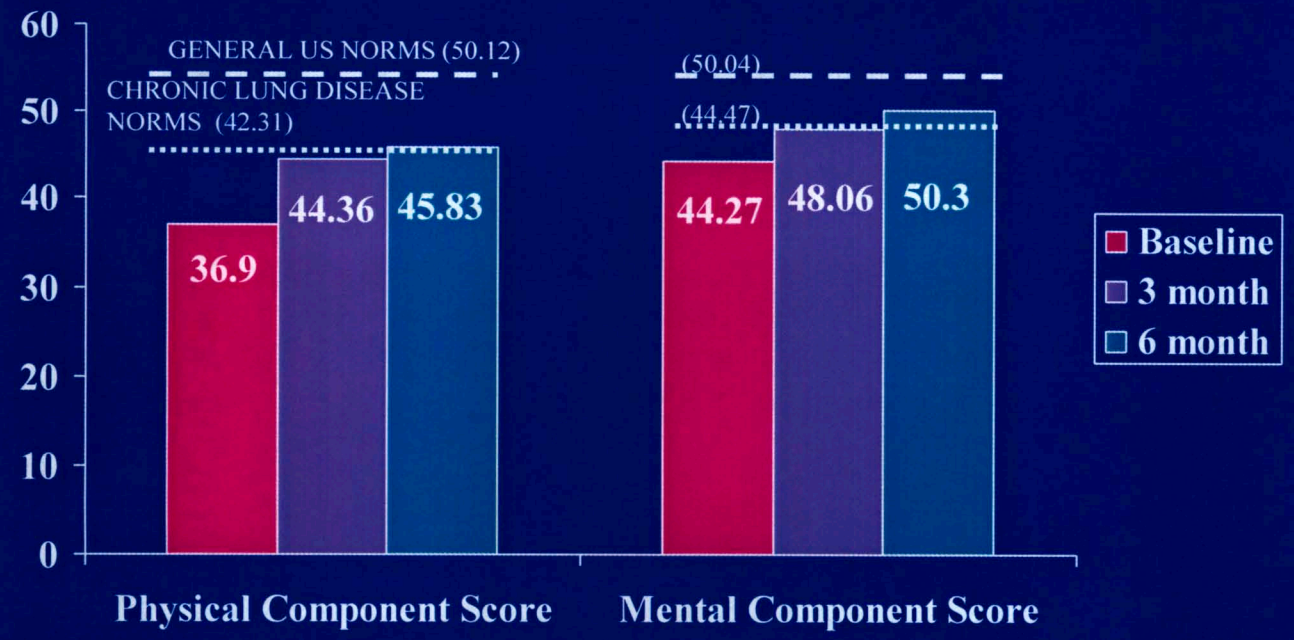
  .044 Inpatient visits per patient/month before ACE

  versus

  .011 Inpatient visits per patient/month after ACE (education)

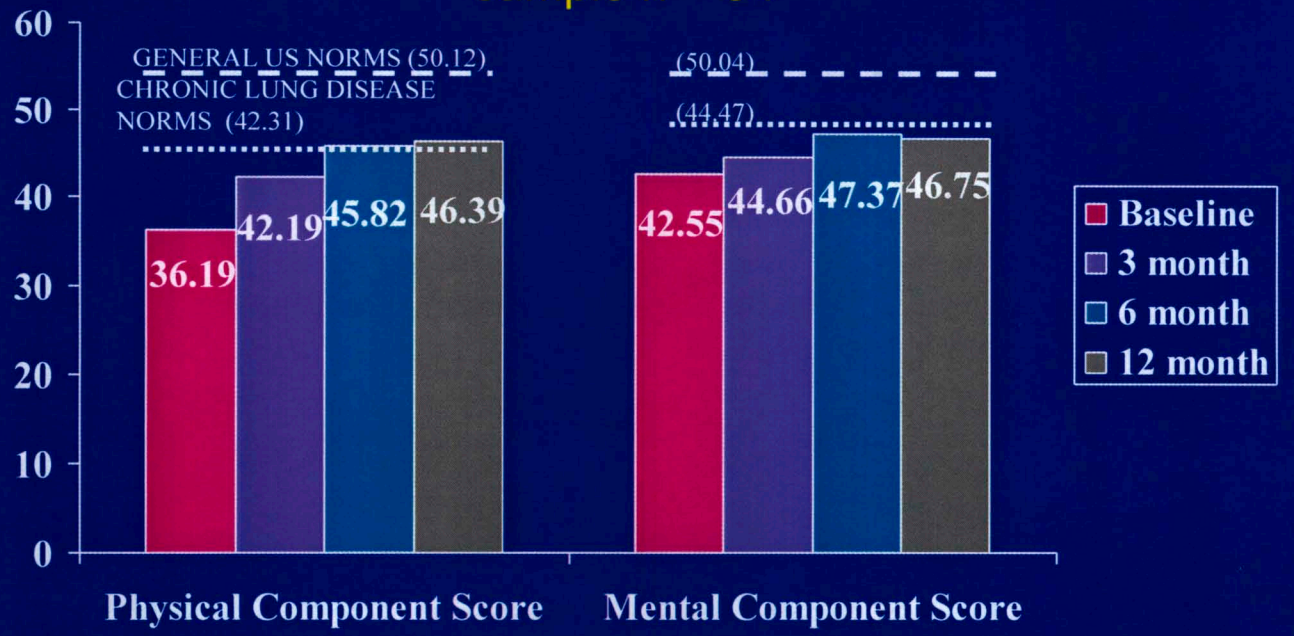
- This is equivalent to a 76.8% reduction in the number of Inpatient visits

Appendix C figure 6
Asthma (ACE) Program:
Baseline to 3 month to 6 month SF- 36 Scores
1.1.97 - 12.30.99
sample n = 107



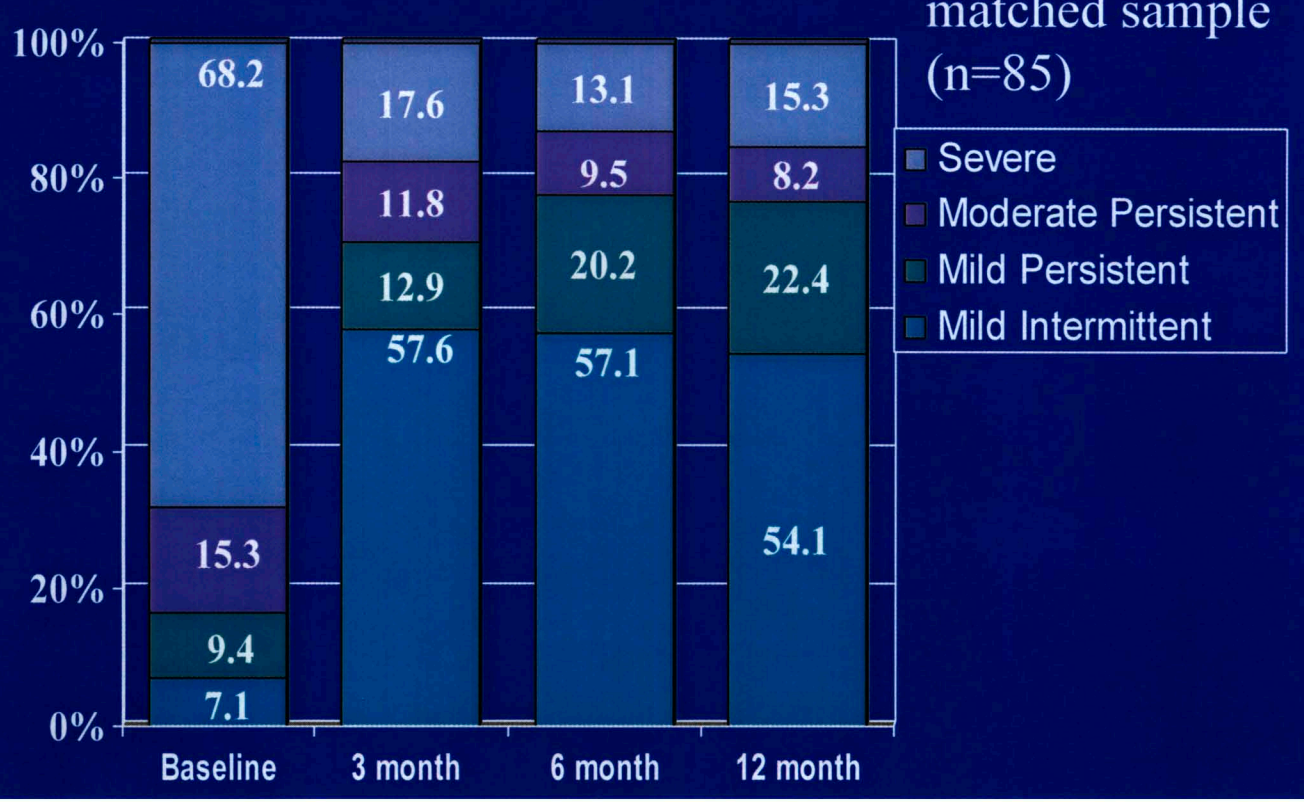
Multivariate Wilks Lamda= .487 F(4,103)= 27.16 p<.001

Appendix C Figure 7
Asthma (ACE) Program:
Baseline to 3 month, 6 month, and 12 month SF- 36 Scores
1.1.97 - 12.30.99
sample n = 54

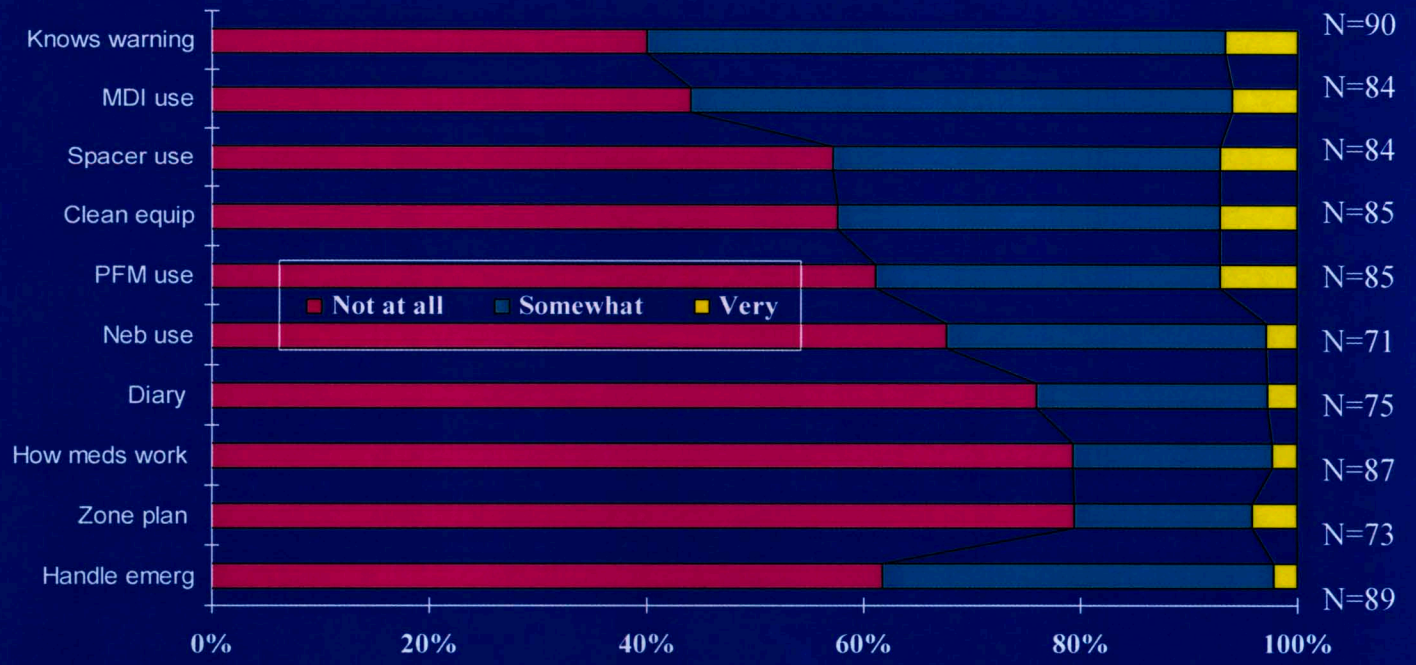


Multivariate Wilks Lamda= .442 F(6,48)= 10.12 p<.001

Appendix C Figure 8
ACE Program Patients:
Severity rating (modified scale)
Baseline, 3 month, 6 month and 12 month follow-up

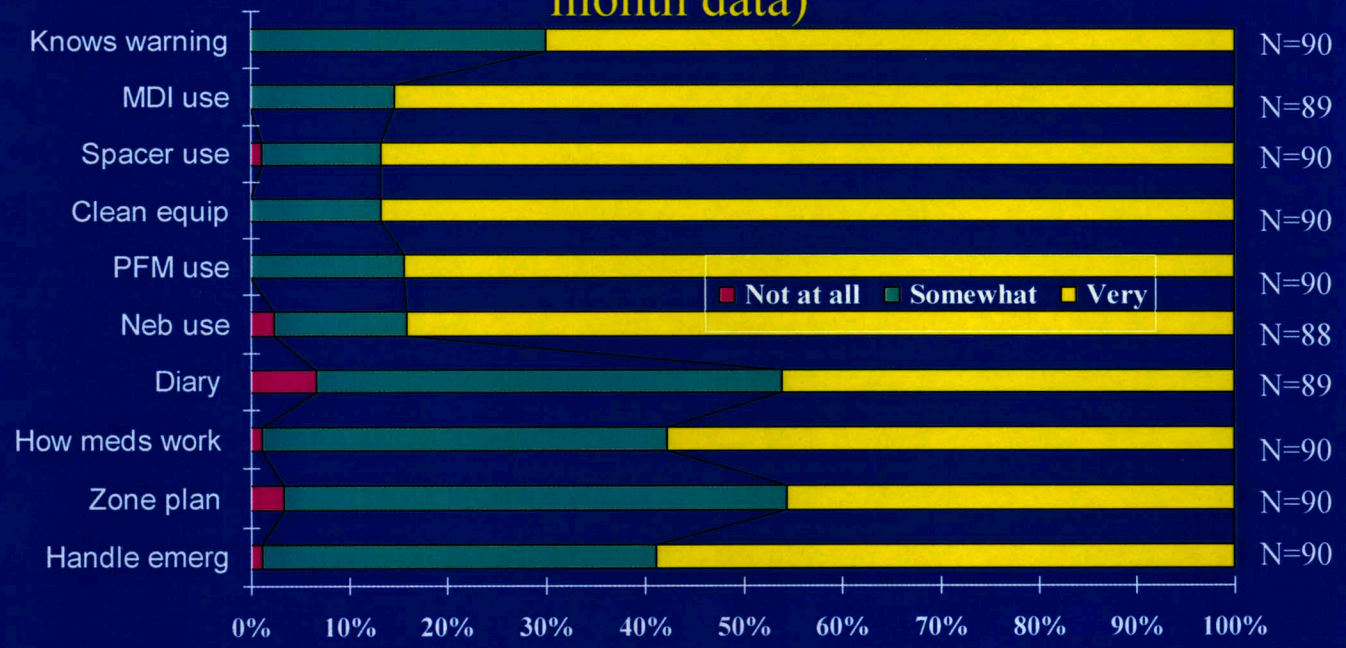


Appendix C Figure 9
ACE Program Patients:
self care skills at baseline (for patients with baseline, 3 month, 6 month and 12 month data)



Appendix C Figure 10 ACE Program Patients: self care skills at 12 month follow-up

(for patients with baseline, 3 month, 6 month and 12 month data)



For the set of 10 skills there was a significant overall improvement from baseline to 3month to 6 month to 12 months. (Wilks-Lamda=.093 $F(30,414)=17.23$ $p<.001$)(n=51)

Asthma Control and Education Program (ACE)

Hartford Hospital

Appendix D

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Sheryl Horowitz PhD

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I. ACE Project Research Hypotheses

Data for the following hypotheses include 388 individuals enrolled in the ACE program between January 2, 1997 and March 31, 1999. For analysis purposes the totals found in the following tables will vary depending on the numbers of individuals who complete the instrument and for some comparisons, individuals were excluded who did not complete their education within the designated period.

To address the resource utilization hypotheses, a sub-sample of 115 patients meeting the following two criteria were extracted from the total sample: 1)individuals who had any inpatient or emergency department experiences during a period of 12 months prior to enrollment and 2) individuals with at least one year of post- enrollment hospital data. Inpatient and emergency department visits were combined for an equivalent period of 12 months prior to and post enrollment.

Hypothesis 1: There is a positive correlation between perceived social support and functional health status e.g. patients with a low level of perceived social support will report lower levels of function.

The Dartmouth COOP single item instrument (citation) was used to measure the extent to which the patient felt that help was available. 90% of the available sample responded. Those patients who completed the 3 month follow-up were similar to those who did not (Chi-Square= 1.3 ns). The frequency distribution of those responses is as follows:

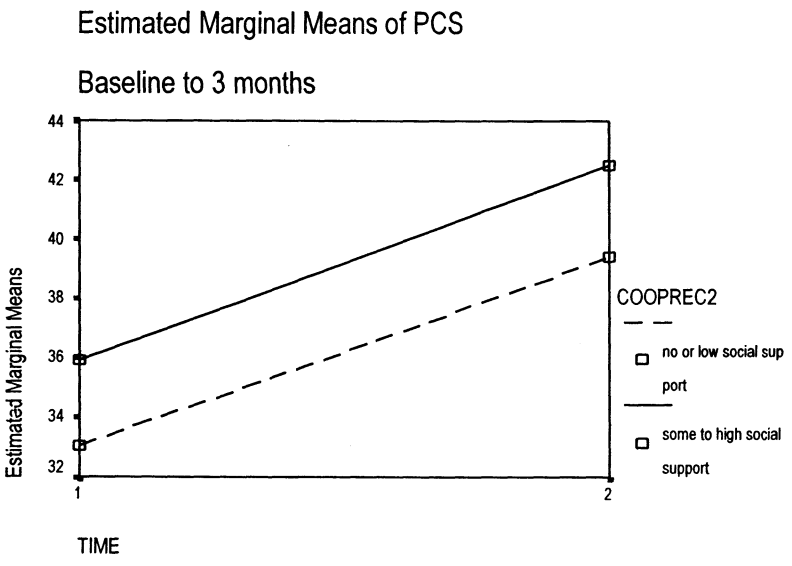
COOP baseline

			Baseline only	Matched sample	Total
COOP baseline	no, not at all	Count	17	10	**27**
		Column %	7.0%	9.3%	**7.7%**
	yes, a little	Count	41	15	**56**
		Column %	16.8%	13.9%	**15.9%**
	yes, some	Count	52	21	**73**
		Column %	21.3%	19.4%	**20.7%**
	yes, quite a bit	Count	67	33	**100**
		Column %	27.5%	30.6%	**28.4%**
	yes, as much as I wanted	Count	67	29	**96**
		Column %	27.5%	26.9%	**27.3%**
Total		Count	**244**	**108**	**352**
		Column %	**100.0%**	**100.0%**	**100.0%**

Using a generalized linear model (GLM) for repeated measures [SPSS (v 10), 1999] with a modified COOP scoring that collapsed the 2 categories of lowest social support (n = 25) and the 3 categories of highest support, (n=83) there is no difference in improvement in the SF-36 Physical Component Summary Scores (PCS) from baseline to 3 months for these two groups. While the low social support group has a slightly lower mean baseline and 3 month follow-up score, both groups proportionately improve their PCS scores from baseline to 3 months. (Multivariate Wilks' lambda = .833 F(1 106)= 21.04 p<.001). It should be noted however, that the small numbers within the COOP categories compromise the power and ability to definitively state that no differences exist between these two groups.

Descriptive Statistics

	COOPREC2	Mean	Std. Deviation	N
STANDARDIZED PHYSICAL COMPONENT SCALE-base	no or low social support	33.0394	11.0754	25
	some to high social support	35.9399	11.1807	83
	Total	35.2685	11.1725	108
STANDARDIZED PHYSICAL COMPONENT SCALE-3mo	no or low social support	39.3955	12.4959	25
	some to high social support	42.5104	11.5728	83
	Total	41.7894	11.8069	108



Hypothesis 2: There is a negative correlation between perceived social support and resource utilizations e.g. patients with a low level of perceived social support will have a greater number of ED visits and inpatient admissions.

Inpatient visits and emergency department visits were combined over the period of 12 months prior and post enrollment. The actual numeric change was calculated and then

dichotomized into 2 groups depending on whether visits decreased or increased (includes unchanged) over the period.

Change in Inpatient Visits from 12 months pre program to 12 months post program

		Frequency	Percent	Valid Percent
Valid	decrease visits	34	29.6	75.6
	Stay same or Increase visits	11	9.6	24.4
	Total	45	39.1	100.0
Missing	9.00	70	60.9	
Total		115	100.0	

Change in Emergency Dept. Visits from 12 months pre program to 12 months post program

		Frequency	Percent	Valid Percent
Valid	decrease visits	80	69.6	76.2
	Stay same or Increase visits	25	21.7	23.8
	Total	105	91.3	100.0
Missing	9.00	10	8.7	
Total		115	100.0	

45 (39%) patients had in-patient visits and 105 (91%) had emergency dept. visits.

Differences exist (Pearson Chi- Square 10.71 p=.001) between the group with hospital utilization and the remaining ACE sample with a lower proportion of persons lacking social support represented in the group with hospital utilization.

Social Support sample differences

		Not in RU	Resource Util sample	**Total**
no or low social support	Count	71	12	**83**
	Row %	85.5%	14.5%	**100.0%**
	Column %	28.2%	12.0%	**23.6%**
some to high social support	Count	181	88	**269**
	Row %	67.3%	32.7%	**100.0%**
	Column %	71.8%	88.0%	**76.4%**
Total	Count	**252**	**100**	**352**
	Row %	**71.6%**	**28.4%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

This finding would tend to support a rejection of the above hypothesis, but in an actual test of the association, both chi-square and Fisher's Exact Test indicate that there are no significant differences between these two groups.

Emergency Department Visits

		decrease visits	Stay same or Increase visits	**Total**
no or low social support	Count	9	2	**11**
	Row %	81.8%	18.2%	**100.0%**
	Column %	12.9%	9.1%	**12.0%**
some to high social support	Count	61	20	**81**
	Row %	75.3%	24.7%	**100.0%**
	Column %	87.1%	90.9%	**88.0%**
Total	Count	**70**	**22**	**92**
	Row %	**76.1%**	**23.9%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

In patient visits

		decrease visits	Stay same or Increase visits	**Total**
no or low social support	Count	3	2	**5**
	Row %	60.0%	40.0%	**100.0%**
	Column %	10.7%	25.0%	**13.9%**
some to high social support	Count	25	6	**31**
	Row %	80.6%	19.4%	**100.0%**
	Column %	89.3%	75.0%	**86.1%**
Total	Count	**28**	**8**	**36**
	Row %	**77.8%**	**22.2%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

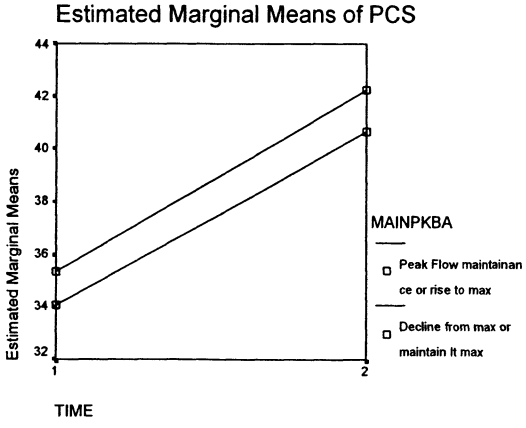
HYPOTHESIS 3- There is a positive correlation between maintenance of Peak Flows at Personal Best and Functional Health Status

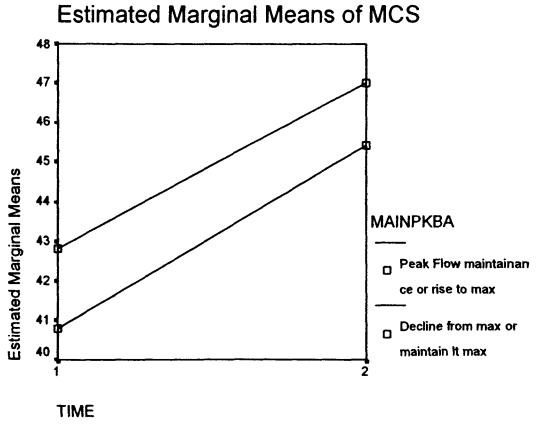
Data distribution of the % of individuals who are at their personal best indicates that at baseline approximately 35% of ACE patients are at their personal best and by the 6-month point this has risen to 75%.

Two categories are created from the % of personal best scores: (1) those who maintain a maximum personal best (n=52) and (2) those whose % is below maximal or who drop from maximal to sub-maximal (< 100%)(n=23) Using a GLM- Repeated measures analysis that looks at the change from baseline to 3 months in the PCS and MCS scores for these two groups of patients, there is no difference between the % of personal best groups in their comparative improvement over time. That is, there is an overall improvement from baseline to 3 months (Multivariate Wilks Lambda= .723 F(2,72)= 13.76 p<.001).for both groups. And although the group maintaining their personal best peak flows have slightly higher scores at both baseline and 3 months these are not significant (Multivariate Wilks Lambda= .99 F(2,72)= .343 p = ns).

4. MAINPKBA * TIME

					95% Confidence Interval	
Measure	MAINPKBA	TIME	Mean	Std. Error	Lower Bound	Upper Bound
PCS	Peak Flow maintainance or rise to max	1	35.351	1.557	32.247	38.455
		2	42.242	1.658	38.938	45.547
	Decline from max or maintain lt max	1	34.053	2.342	29.386	38.720
		2	40.666	2.493	35.697	45.635
MCS	Peak Flow maintainance or rise to max	1	42.813	1.814	39.198	46.428
		2	46.997	1.536	43.937	50.057
	Decline from max or maintain lt max	1	40.785	2.727	35.350	46.220
		2	45.424	2.309	40.822	50.025

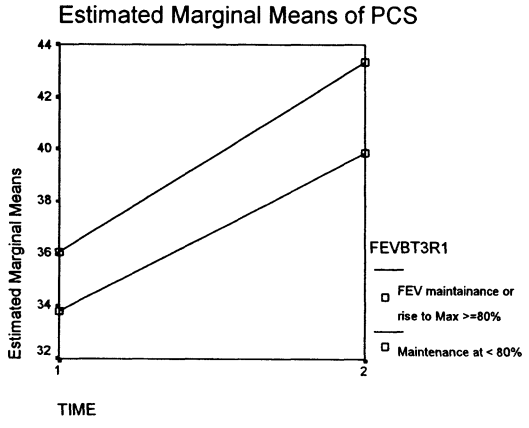


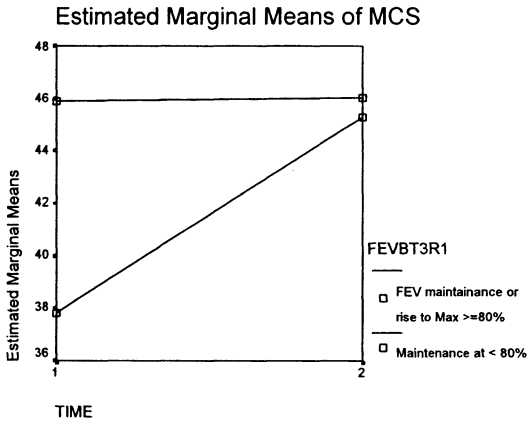


Results using the FEV % of maximum measurements are consistent with those for Peak Flow readings. In this case the overall sample is smaller n= 49, and is evenly divided between the maintenance and sub-maintenance groups (n=24, 25 respectively). Despite the graph showing a steeper rise in the group who have submaximal FEV scores, for the MCS from baseline to 3 months, this change is not a statistically significant interaction

4. FEVBT3R1 * TIME

					95% Confidence Interval	
Measure	FEVBT3R1	TIME	Mean	Std. Error	Lower Bound	Upper Bound
PCS	FEV maintainance or rise to Max >=80%	1	36.048	2.450	31.119	40.977
		2	43.338	2.361	38.588	48.088
	Maintenance at < 80%	1	33.798	2.401	28.969	38.628
		2	39.857	2.313	35.203	44.511
MCS	FEV maintainance or rise to Max >=80%	1	45.897	2.489	40.889	50.905
		2	46.004	2.405	41.165	50.843
	Maintenance at < 80%	1	37.824	2.439	32.917	42.731
		2	45.284	2.357	40.543	50.025





HYPOTHESIS 4- Patients who do not maintain peak flows will have a greater number of ED visits and in patient admissions.

In analyzing the subsample with hospital utilization it is important to consider whether that sample is representative of the overall patient population from which it is drawn.Although differences exist between the resource and general sample, that might reflect a heavier use of hospital resources by those with less control of their Peak Flow and FEV, these differences are not statistically significant Fisher's Exact (2 sided, p=.146, p= 1.000 respectively)

Peak Flow maintainence sample comparison

		Not in RU	Resource Util sample	**Total**
Peak Flow maintainance or rise to max	Count	62	23	**85**
	Row %	72.9%	27.1%	**100.0%**
	Column %	72.9%	59.0%	**68.5%**
Decline from max or maintain lt max	Count	23	16	**39**
	Row %	59.0%	41.0%	**100.0%**
	Column %	27.1%	41.0%	**31.5%**
Total	Count	**85**	**39**	**124**
	Row %	**68.5%**	**31.5%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

FEV maintainence sample comparison

		Not in RU	Resource Util sample	**Total**
FEV maintainance or rise to Max >=80%	Count	17	12	**29**
	Row %	58.6%	41.4%	**100.0%**
	Column %	43.6%	41.4%	**42.6%**
Maintenance at < 80%	Count	22	17	**39**
	Row %	56.4%	43.6%	**100.0%**
	Column %	56.4%	58.6%	**57.4%**
Total	Count	**39**	**29**	**68**
	Row %	**57.4%**	**42.6%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

In chi-square analyses associating the maintenance of peak-flow or FEV with changes in hospital utilization, none of the results was statistically significant and in fact extremely low sample sizes make it impossible to draw any conclusions from this data.

FEV compared with in patient visits

		decrease visits	Stay same or Increase visits	**Total**
FEV maintainance or rise to Max >=80%	Count	2		**2**
	Row %	100.0%		**100.0%**
	Column %	28.6%		**25.0%**
Maintenance at < 80%	Count	5	1	**6**
	Row %	83.3%	16.7%	**100.0%**
	Column %	71.4%	100.0%	**75.0%**
Total	Count	7	1	**8**
	Row %	**87.5%**	**12.5%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

Peak Flow compared to in patient visits

		decrease visits	Stay same or Increase visits	**Total**
Peak Flow maintainance or rise to max	Count	4	4	**8**
	Row %	50.0%	50.0%	**100.0%**
	Column %	36.4%	80.0%	**50.0%**
Decline from max or maintain lt max	Count	7	1	**8**
	Row %	87.5%	12.5%	**100.0%**
	Column %	63.6%	20.0%	**50.0%**
Total	Count	**11**	**5**	**16**
	Row %	**68.8%**	**31.3%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

FEV compared to Emergency Dept visits

		decrease visits	Stay same or Increase visits	Total
FEV maintainance or rise to Max >=80%	Count	9	3	**12**
	Row %	75.0%	25.0%	**100.0%**
	Column %	40.9%	60.0%	**44.4%**
Maintenance at < 80%	Count	13	2	**15**
	Row %	86.7%	13.3%	**100.0%**
	Column %	59.1%	40.0%	**55.6%**
Total	Count	**22**	**5**	**27**
	Row %	**81.5%**	**18.5%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

Peak Flow compared to Emergency Dept Visits

		decrease visits	Stay same or Increase visits	Total
Peak Flow maintainance or rise to max	Count	18	4	**22**
	Row %	81.8%	18.2%	**100.0%**
	Column %	72.0%	40.0%	**62.9%**
Decline from max or maintain lt max	Count	7	6	**13**
	Row %	53.8%	46.2%	**100.0%**
	Column %	28.0%	60.0%	**37.1%**
Total	Count	**25**	**10**	**35**
	Row %	**71.4%**	**28.6%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

HYPOTHESIS 5- There is a positive correlation between Asthma knowledge and Functional Health Status

Patients were compared from baseline to 3 months on their knowledge of Asthma and were categorized by whether that knowledge improved or declined. Similarly, Physical

Summary scores were compared during this period and grouped into those who improved their scores or those whose scores declined over that period. The results were tested using the Pearson chi-square. While four of the comparisons were significant at the .p=.05 level, because of the possibility of a TYPE I error inflation due to multiple comparisons, a Bonferonni correction resulted in non significant results for all comparisons. It should be noted that a trend does exist wherein those whose knowledge declined or stayed the same are less proportionately represented in the group with improved PCS scores. It is not however apparent that there is a difference between those who improve as compared to those who greatly improve. For example, in the question of whether the patient knows how to use an MDI, of those whose knowledge declined over time, only 40% showed improvement in their PCS scores, while for those whose knowledge improved, 70% of these individuals showed improvement in their PCS scores from baseline to 3 months.

Percent of patients whose knowledge of Asthma changed from baseline to 3months compared to their Sf-36 Physical Component Score improvement

		PCS decline or stay same		PCS Improved		Total	
		Count	Row %	Count	Row %	Count	Row %
Knows warning signs	declined or stayed same	12	35.3%	22	64.7%	34	100.0%
	improved	17	34.0%	33	66.0%	50	100.0%
	greatly improved	5	29.4%	12	70.6%	17	100.0%
Knows use of MDI (p=.04 uncorrected)	declined or stayed same	12	60.0%	8	40.0%	20	100.0%
	improved	16	29.6%	38	70.4%	54	100.0%
	greatly improved	7	29.2%	17	70.8%	24	100.0%
Knows how to use PFM	declined or stayed same	9	50.0%	9	50.0%	18	100.0%
	improved	9	30.0%	21	70.0%	30	100.0%
	greatly improved	16	34.0%	31	66.0%	47	100.0%
Knows how to use spacer	declined or stayed same	10	52.6%	9	47.4%	19	100.0%
	improved	11	33.3%	22	66.7%	33	100.0%
	greatly improved	13	28.9%	32	71.1%	45	100.0%
Knows how to use nebulizer	declined or stayed same	5	45.5%	6	54.5%	11	100.0%
	improved	6	20.7%	23	79.3%	29	100.0%
	greatly improved	12	37.5%	20	62.5%	32	100.0%
Can verbalize how meds work (p=.045 uncorrected)	declined or stayed same	9	64.3%	5	35.7%	14	100.0%
	improved	12	31.6%	26	68.4%	38	100.0%
	greatly improved	13	28.9%	32	71.1%	45	100.0%
Knows how to clean equipment	declined or stayed same	6	46.2%	7	53.8%	13	100.0%
	improved	13	27.7%	34	72.3%	47	100.0%
	greatly improved	15	36.6%	26	63.4%	41	100.0%
Records PFM in diary (p=.02 uncorrected)	declined or stayed same	8	66.7%	4	33.3%	12	100.0%
	improved	11	25.0%	33	75.0%	44	100.0%
	greatly improved	8	29.6%	19	70.4%	27	100.0%
Knows PF zone plan (p=.04 uncorrected)	declined or stayed same	5	71.4%	2	28.6%	7	100.0%
	improved	10	26.3%	28	73.7%	38	100.0%
	greatly improved	9	26.5%	25	73.5%	34	100.0%
Knows how to handle asthma emergencies	declined or stayed same	10	52.6%	9	47.4%	19	100.0%
	improved	15	29.4%	36	70.6%	51	100.0%
	greatly improved	8	28.6%	20	71.4%	28	100.0%

HYPOTHESIS 6- Negative correlation between Asthma knowledge and Resource utilization.

None of the comparisons between self care skills and inpatient stays showed significant associations between improved knowledge and decreased inpatient stays. It should be noted that sample sizes are very low. The same pattern of non-significance is also true for the emergency dept visits; however, most skills (with the exception of warning signs and knowledge of meds) show the same trend discussed above where emergency dept visits decrease more in those with improved self care skills.

Percent of patients whose knowledge of Asthma changed from baseline to 3months compared to their change in Inpatient hospital visits

		In patient visits decrease		IP Stay same or Increase visits		Total	
		Count	Row %	Count	Row %	Count	Row %
Knows warning signs	declined or stayed same	4	66.7%	2	33.3%	6	100.0%
	improved	4	66.7%	2	33.3%	6	100.0%
	greatly improved	6	66.7%	3	33.3%	9	100.0%
Knows use of MDI	declined or stayed same	2	100.0%			2	100.0%
	improved	7	77.8%	2	22.2%	9	100.0%
	greatly improved	4	50.0%	4	50.0%	8	100.0%
Knows how to use PFM	declined or stayed same	3	100.0%			3	100.0%
	improved	3	50.0%	3	50.0%	6	100.0%
	greatly improved	8	72.7%	3	27.3%	11	100.0%
Knows how to use spacer	declined or stayed same	2	100.0%			2	100.0%
	improved	6	75.0%	2	25.0%	8	100.0%
	greatly improved	5	55.6%	4	44.4%	9	100.0%
Knows how to use nebulizer	declined or stayed same	2	100.0%			2	100.0%
	improved	4	57.1%	3	42.9%	7	100.0%
	greatly improved	7	70.0%	3	30.0%	10	100.0%
Can verbalize how meds work	declined or stayed same	4	100.0%			4	100.0%
	improved	3	50.0%	3	50.0%	6	100.0%
	greatly improved	8	72.7%	3	27.3%	11	100.0%
Knows how to clean equipment	declined or stayed same	3	100.0%			3	100.0%
	improved	3	37.5%	5	62.5%	8	100.0%
	greatly improved	9	81.8%	2	18.2%	11	100.0%
Records PFM in diary	declined or stayed same	3	100.0%			3	100.0%
	improved	3	37.5%	5	62.5%	8	100.0%
	greatly improved	9	90.0%	1	10.0%	10	100.0%
Knows PF zone plan	declined or stayed same	4	100.0%			4	100.0%
	improved	3	50.0%	3	50.0%	6	100.0%
	greatly improved	8	72.7%	3	27.3%	11	100.0%
Knows how to handle asthma emergencies	declined or stayed same	2	100.0%			2	100.0%
	improved	5	62.5%	3	37.5%	8	100.0%
	greatly improved	6	66.7%	3	33.3%	9	100.0%

Percent of patients whose knowledge of Asthma changed from baseline to 3months compared to their change in Emergency dept. hospital visits

		decrease visits		Stay same or Increase visits		Total	
		Count	Row %	Count	Row %	Count	Row %
Knows warning signs	declined or stayed same	8	72.7%	3	27.3%	11	100.0%
	improved	18	78.3%	5	21.7%	23	100.0%
	greatly improved	12	75.0%	4	25.0%	16	100.0%
Knows use of MDI	declined or stayed same	3	60.0%	2	40.0%	5	100.0%
	improved	21	80.8%	5	19.2%	26	100.0%
	greatly improved	12	70.6%	5	29.4%	17	100.0%
Knows how to use PFM	declined or stayed same	3	50.0%	3	50.0%	6	100.0%
	improved	13	81.3%	3	18.8%	16	100.0%
	greatly improved	20	76.9%	6	23.1%	26	100.0%
Knows how to use spacer	declined or stayed same	3	60.0%	2	40.0%	5	100.0%
	improved	15	78.9%	4	21.1%	19	100.0%
	greatly improved	18	78.3%	5	21.7%	23	100.0%
Knows how to use nebulizer	declined or stayed same	3	60.0%	2	40.0%	5	100.0%
	improved	14	82.4%	3	17.6%	17	100.0%
	greatly improved	16	72.7%	6	27.3%	22	100.0%
Can verbalize how meds work	declined or stayed same	5	71.4%	2	28.6%	7	100.0%
	improved	14	77.8%	4	22.2%	18	100.0%
	greatly improved	18	75.0%	6	25.0%	24	100.0%
Knows how to clean equipment	declined or stayed same	3	60.0%	2	40.0%	5	100.0%
	improved	15	78.9%	4	21.1%	19	100.0%
	greatly improved	21	75.0%	7	25.0%	28	100.0%
Records PFM in diary	declined or stayed same	3	60.0%	2	40.0%	5	100.0%
	improved	17	77.3%	5	22.7%	22	100.0%
	greatly improved	18	75.0%	6	25.0%	24	100.0%
Knows PF zone plan	declined or stayed same	4	66.7%	2	33.3%	6	100.0%
	improved	16	84.2%	3	15.8%	19	100.0%
	greatly improved	16	66.7%	8	33.3%	24	100.0%
Knows how to handle asthma emergencies	declined or stayed same	3	50.0%	3	50.0%	6	100.0%
	improved	18	90.0%	2	10.0%	20	100.0%
	greatly improved	15	65.2%	8	34.8%	23	100.0%

HYPOTHESIS 7 – There is a positive correlation between attendance in the ACE program and functional status.

The program was structured so that patients would only take a few weeks to complete the 3 education sessions. When patients missed their appointments, they would be

rescheduled at a later time resulting in an increased length of time to education completion. Time to complete education is therefore used as a proxy for missed appointments and the hypothesis would be that longer education times would be associated with less improvement in functional scores. A variable EDTIME recorded the number of days to complete education. A one-way ANOVA was used to compare the improvement from baseline to 3 month on the Physical Component Score of the SF-36 with the time taken to complete education. Results are not statistically significant. A second comparison using whether the individual completed the program (returned for the 6 month follow-up) also showed no statistical significance with respect to differences in the PCS score from baseline to 3 month follow-up, although the percent differences were in the desired direction..

Change in PCS from baseline to 3 month compared to number of days to complete program education

EDTIME

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
decline or stay same	38	81.5526	51.8734	8.4150	64.5023	98.6030	28.00	206.00
Improve	72	89.0972	78.6572	9.2698	70.6137	107.581	20.00	498.00
Total	110	86.4909	70.4020	6.7126	73.1868	99.7950	20.00	498.00

ANOVA

EDTIME

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1415.777	1	1415.777	.284	.595
Within Groups	538835.714	108	4989.220		
Total	540251.491	109			

rogram completion compared to change in PCS from baseline t 3 month

			decline or stay same	Improve	Total
Finished program (6mo f/u)	did not finish program	Count	10	14	**24**
		Row %	41.7%	58.3%	**100.0%**
	Finished program (6 mo f/u)	Count	28	58	**86**
		Row %	32.6%	67.4%	**100.0%**
Total		Count	**38**	**72**	**110**
		Row %	**34.5%**	**65.5%**	**100.0%**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.688[b]	1	.407	
Continuity Correction [a]	.345	1	.557	
Likelihood Ratio	.675	1	.411	
Fisher's Exact Test				.469
Linear-by-Linear Association	.682	1	.409	
N of Valid Cases	110			

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.29.

HYPOTHESIS 8 – there is a negative correlation between attendance in the ACE program and resource utilization.

Two measures were used to test this hypothesis. 1): whether the patient completed or did not complete their education and 2) whether a patient finished the program to the 6th month point. Comparisons of the hospital utilization sample to the remaining patients indicated that a higher proportion of patients who ended up finishing the program are found to have used the hospital resources compared to those who did not finish the program (Pearson Chi- Square =4.88 p= .027). This difference was not found for those who did and did not complete the educational component.

Proportion of sample utilizing hospital resources compared to program completion

			Not in RU	Resource Util sample	Total
Finished program (6mo f/u)	did not finish program	Count	172	62	**234**
		Row %	73.5%	26.5%	**100.0%**
	Finished program (6 mo f/u)	Count	89	53	**142**
		Row %	62.7%	37.3%	**100.0%**
Total		Count	**261**	**115**	**376**
		Row %	**69.4%**	**30.6%**	**100.0%**

Proportion of sample using hospital resources compared to finishing education

		Not in RU	Resource Util sample	Total
Did not finish education and enrolled before 1.99	Count	90	41	**131**
	Row %	69%	31.3%	**100.0%**
Finished education	Count	156	74	**230**
	Row %	68%	32.2%	**100.0%**
Total	Count	**246**	**115**	**361**
	Row %	**68%**	**31.9%**	**100.0%**

Neither of these measures of program attendance reflected a significant difference in whether a patient's inpatient or emergency department utilization of hospital resources decreased from pre to post program participation. In general, 70 % or more individuals decreased the number of inpatient and emergency room visits regardless of whether they

finish education or the program itself. The actual numbers, however, show differences such that those who do not finish are more likely to decrease their visits than their counterparts who go on to complete the education or program.

In patient visits from baseline to 3 month compared to program completion

			decrease visits	Stay same or Increase visits	Total
Finished program (6mo f/u)	did not finish program	Count	20	5	**25**
		Row %	80.0%	20.0%	**100.0%**
	Finished program (6 mo f/u)	Count	14	6	**20**
		Row %	70.0%	30.0%	**100.0%**
Total		Count	**34**	**11**	**45**
		Row %	**75.6%**	**24.4%**	**100.0%**

In patient visits from baseline to 3 month compared to education completion

		decrease visits	Stay same or Increase visits	Total
Did not finish education and enrolled before 1.99	Count	11	4	**15**
	Row %	73.3%	26.7%	**100.0%**
Finished education	Count	23	7	**30**
	Row %	76.7%	23.3%	**100.0%**
Total	Count	**34**	**11**	**45**
	Row %	**75.6%**	**24.4%**	**100.0%**

ergency dept. visits from baseline to 3 month compared program completion

			decrease visits	Stay same or Increase visits	Total
Finished program (6mo f/u)	did not finish program	Count	45	10	**55**
		Row %	81.8%	18.2%	**100.0%**
	Finished program (mo f/u)	Count	35	15	**50**
		Row %	70.0%	30.0%	**100.0%**
Total		Count	**80**	**25**	**105**
		Row %	**76.2%**	**23.8%**	**100.0%**

Emergency dept. visits from baseline to 3 month compared to education completion

			decrease visits	Stay same or Increase visits	Total
Finished eduction	Did not finish education and enrolled before 1.99	Count	31	7	**38**
		Row %	81.6%	18.4%	**100.0%**
	Finished education	Count	49	18	**67**
		Row %	73.1%	26.9%	**100.0%**
Total		Count	**80**	**25**	**105**
		Row %	**76.2%**	**23.8%**	**100.0%**

HYPOTHESIS 9- Patients with more severe Asthma {using the modified NIH Symptom scale} will show lower levels of function

Due to an instrument change, the information used to construct the NIH severity scale was adjusted in order to maintain data comparability over time. A modified severity scale was generated that omitted 2 questions. The severity classification of those who were re-categorized on the item level did not result in an overall re-classification of severity.

At baseline and at 3months the NIH severity groups showed differences in their corresponding Physical Component Summary scores. At both time points those with more severe classifications were associated with lower PCS functioning for that time

period. Baseline differences were more pronounced than those at 3 months. The baseline one-way ANOVA, ($F(3,284) = 8.13$) was significant at $p<.001$. Scheffe post hoc analysis showed significant differences between Severe and Mild or Moderate Persistent and between Moderate Persistent and Mild Intermittent. At the 3 month follow-up, the one-way ANOVA, ($F(3,120) = 4.32$) was significant at $p=.006$. Scheffe post-hoc analysis showed only significant difference between the severe and mild-intermittent categories.

Baseline PCS

STANDARDIZED PHYSICAL COMPONENT SCALE-base

				95% Confidence Interval for Mean	
	N	Mean	Std. Deviation	Lower Bound	Upper Bound
Mild Intermittent	20	43.15	12.0908	37.4907	48.8080
Mild Persistent	21	40.24	8.8263	36.2202	44.2555
Moderate Persistent	44	33.59	10.1898	30.4901	36.6860
Severe	203	33.44	9.8737	32.0755	34.8084
Total	288	34.63	10.3828	33.4297	35.8381

3 month F/U

STANDARDIZED PHYSICAL COMPONENT SCALE-3mo

				95% Confidence Interval for Mean	
	N	Mean	Std. Deviation	Lower Bound	Upper Bound
Mild Intermittent	64	44.611	10.7143	41.935	47.287
Mild Persistent	18	43.868	10.5931	38.600	49.136
Moderate Persistent	19	40.889	12.2135	35.002	46.776
Severe	23	34.951	12.7168	29.452	40.450
Total	124	42.141	11.7721	40.049	44.234

To analyze change over time, individuals at baseline were compared with their status at 3 months and a variable constructed to indicate improvement. The sample is roughly evenly divided between three groups; those who worsen, those who improve and those who improve greatly.

Descriptive Statistics

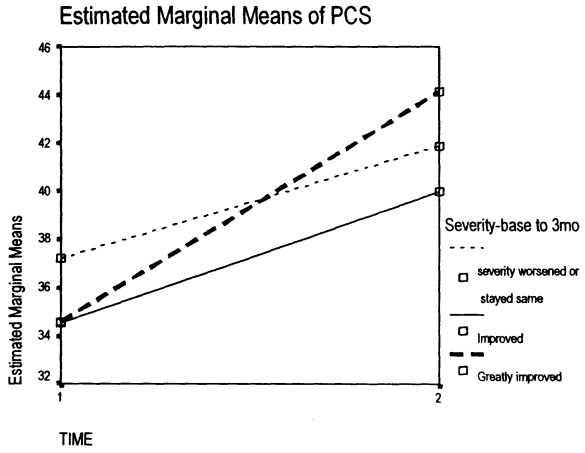
	Severity Change	Mean	Std. Deviation	N
STANDARDIZED PHYSICAL COMPONENT SCALE-base	severity worsened or stayed same	37.1973	12.7203	33
	Improved	34.5275	9.0957	41
	Greatly improved	34.5776	11.7903	32
	Total	35.3738	11.1080	106
STANDARDIZED PHYSICAL COMPONENT SCALE-3mo	severity worsened or stayed same	41.8969	12.7408	33
	Improved	39.9538	11.4131	41
	Greatly improved	44.1559	11.3332	32
	Total	41.8273	11.8338	106

Using a GLM repeated measures methodology, individuals grouped by their NIH severity change from baseline to 3 months were compared relative to the change in their Physical Component Scores during that same time. Using the test of within subjects effects, the results show that while there are significant changes in the PCS scores over time ($F=30.38$ $p<.001$), tests of between subjects effects (NIH scale) are not significant ($F=.655$ p=ns)

NIH change * TIME

Measure: MEASURE_1

NIH change	TIME	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
severity worsened or stayed same	1	37.197	1.940	33.349	41.045
	2	41.897	2.057	37.817	45.977
Improved	1	34.528	1.741	31.075	37.980
	2	39.954	1.846	36.293	43.614
Greatly improved	1	34.578	1.970	30.670	38.485
	2	44.156	2.089	40.012	48.299



Although not significant it might be noted that the graph showing the PCS change from base to 3 months suggests that those who greatly improve on the NIH severity scale show the most pronounced rate of improvement on the PCS.

HYPOTHESIS 10- There is a positive correlation between Asthma severity (using the modified NIH symptom severity scale) and resource utilization

There is no statistical difference between the group with hospital utilization and the remaining ACE sample with respect to a patient's severity classification at baseline

NIH severity classification sample differences

			Not in RU	Resource Util sample	Total
baseline NIH Severity	Mild Intermittent	Count	18	3	**21**
		Row %	85.7%	14.3%	**100.0%**
		Column %	7.3%	2.8%	**5.9%**
	Mild Persistent	Count	19	8	**27**
		Row %	70.4%	29.6%	**100.0%**
		Column %	7.7%	7.3%	**7.6%**
	Moderate Persistent	Count	34	22	**56**
		Row %	60.7%	39.3%	**100.0%**
		Column %	13.8%	20.2%	**15.7%**
	Severe	Count	176	76	**252**
		Row %	69.8%	30.2%	**100.0%**
		Column %	71.3%	69.7%	**70.8%**
Total		Count	**247**	**109**	**356**
		Row %	**69.4%**	**30.6%**	**100.0%**
		Column %	**100.0%**	**100.0%**	**100.0%**

Analyzing the sample who contribute comparative baseline to 3 month severity change data is small and the low cell counts hinder the ability to draw definitive conclusions concerning the association between severity change and hospital utilization. In addition, noting that the sample under-represents those whose severity class has worsened, it is difficult to have confidence in that category. Overall the tests of difference (Pearson chi-square) among the three categories of NIH severity change are not significant for hospital utilization. It may be noted that for both emergency dept visits and inpatient stays, those who greatly improve have a larger proportion of patients who have a decreased number of hospital visits than those with only "some improvement".

Emergency Dept Visits

		decrease visits	Stay same or Increase visits	Total
severity worsened or stayed same	Count	5	2	7
	Row %	71.4%	28.6%	**100.0%**
	Column %	12.2%	16.7%	**13.2%**
Improved	Count	12	6	**18**
	Row %	66.7%	33.3%	**100.0%**
	Column %	29.3%	50.0%	**34.0%**
Greatly improved	Count	24	4	**28**
	Row %	85.7%	14.3%	**100.0%**
	Column %	58.5%	33.3%	**52.8%**
Total	Count	**41**	**12**	**53**
	Row %	**77.4%**	**22.6%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

In patients visits

		decrease visits	Stay same or Increase visits	Total
severity worsened or stayed same	Count	2		**2**
	Row %	100.0%		**100.0%**
	Column %	12.5%		**9.1%**
Improved	Count	7	5	**12**
	Row %	58.3%	41.7%	**100.0%**
	Column %	43.8%	83.3%	**54.5%**
Greatly improved	Count	7	1	**8**
	Row %	87.5%	12.5%	**100.0%**
	Column %	43.8%	16.7%	**36.4%**
Total	Count	**16**	**6**	**22**
	Row %	**72.7%**	**27.3%**	**100.0%**
	Column %	**100.0%**	**100.0%**	**100.0%**

II *Quality of life/ Missed days of work analysis*.

Questions on quality of life and missed days of work/routine, were added to the patient interview on 2/17/98. 163 patients (out of 176 individuals who enrolled during this period) responded to three questions pertaining to their quality of life and missed days of work in the previous four weeks. Physical activity, social activity and work(usual activities) were rated with respect to how much asthma limited their abilities in these areas. At baseline only 9 % of patients said that their physical activities were not limited at all by their asthma. Concerning social activites 19% of the sample felt that their social activities were not affected by asthma and 25% had not missed any work because of their asthma.

activity limited- base

	Frequency	Valid Percent
Not at all	14	8.6
Slightly	44	27.0
Moderately	56	34.4
Quite a bit	31	19.0
Extremely	18	11.0
Total	163	100.0
Missing	2	
missing	223	
Total	225	
Total	388	

social limited- base

	Frequency	Valid Percent
Not at all	31	19.0
Slightly	35	21.5
Moderately	56	34.4
Quite a bit	30	18.4
Extremely	11	6.7
Total	163	100.0
Missing	2	
missing	223	
Total	225	
Total	388	

work limited- base

	Frequency	Valid Percent
none	38	25.2
1-3 days	39	25.8
4-7 days	29	19.2
8-14 days	18	11.9
> 14 days	27	17.9
Total	151	100.0
Missing	2	
NA	12	
missing	223	
Total	237	
Total	388	

When the sample is restricted to patients with data at both baseline and 3 month follow-up the baseline situation of individuals is slightly improved with 12% having no activity

limitation and those who have not missed any days of work representing 41% of the sample. At the three month point, there are substantial changes with the percentage of persons claiming no limitation in physical activity rising to 56%, those with no social activity limitation becoming 71% and those with no work limitation 73% of those responding. Using a paired sample t-test, each of these changes is significant at the $p < .001$ level.

activity limited- base

	n	Valid Percent
Not at all	9	12.9
Slightly	27	38.6
Moderately	19	27.1
Quite a bit	8	11.4
Extremely	7	10.0
Total	70	100.0
Missing		
Total	72	

social limited- base

	n	Valid Percent
Not at all	19	27.1
Slightly	17	24.3
Moderately	22	31.4
Quite a bit	9	12.9
Extremely	3	4.3
Total	70	100.0
Missing	2	
Total	72	

work limited- base

	n	Valid Percent
none	27	41.5
1-3 days	17	26.2
4-7 days	6	9.2
8-14 days	6	9.2
> 14 days	9	13.8
Total	65	100.0
Missing	2	
NA	5	
Total	7	
Total	72	

When responses are re-coded to reflect whether a person's limitations improved or deteriorated between baseline and 3 months, results showed strong improvements ranging from 67% improving in physical activity to 50% of patients improving the number of days of missed work/routines.

base- 3mo Change in limitation of activity

	n	Valid Percent
Get worse	4	5.7
Stay same	19	27.1
Improve	47	67.1
Total	70	100.0
missing	105	
Total	175	

base- 3mo change in social limitation

	n	Valid Percent
Get worse	5	7.1
Stay same	19	27.1
Improve	46	65.7
Total	70	100.0
Missing	105	
Total	175	

base- 3mo change in work limits

	n	Valid Percent
Get worse	6	9.2
Stay same	27	41.5
Improve	32	49.2
Total	65	100.0
Missing	110	
Total	175	

III Conclusions and Next Steps

In summary, it has been demonstrated that patients participating in the ACE program have had significant reductions in severity and resource utilization and improvements in knowledge, general health status and asthma specific quality of life. The relationships among these variables and others require additional study with larger samples. Patients will continue to be enrolled in ACE and invited to participate in the Outcomes Study. Data collection instruments going forward will include the SF-12, CES-D, NIH severity, Asthma specific QOL and selfcare skills. Resource utilization will continue to be captured through the hospital's administrative database.